
Flanders
State of the Art
STI IN FLANDERS
SCIENCE, TECHNOLOGY & INNOVATION
POLICY & KEY FIGURES
2024
DEPARTMENT OF
ECONOMY
SCIENCE &
INNOVATION


© FlandersMake

STI IN FLANDERS

SCIENCE, TECHNOLOGY & INNOVATION
POLICY & KEY FIGURES 2024

STI in Flanders is a publication of
The Flemish Government,
Department of Economy, Science
and Innovation

Flemish Government
Department EWI
Koning Albert II-laan 35, bus 10
B-1030 Brussels, BELGIUM
Tel.: +32 2 553 59 80
info.ewi@vlaanderen.be
www.ewi-vlaanderen.be

Publisher
Johan Hanssens, Secretary-General

This edition was made possible thanks to contributions from various members of the Department of Economy, Science and Innovation, the Agency for Innovation and Entrepreneurship, the Flemish Department of Foreign Affairs, Flanders Investment and Trade and Statistiek Vlaanderen.

Date of publication
January 2024
Content revised until December 2023

D/2023/3241/408

Concept & Design
The Oval Office

Cover
© Shutterstock

DEPARTMENT OF
ECONOMY
SCIENCE &
INNOVATION

My government has set itself the ambition to become one of the top 5 innovative knowledge regions in Europe.

This publication provides an impressive overview of the innovation landscape that the Flemish Government has established since its acquired competence over science and innovation. It shows that Flanders is one of the European hot spots to invest in for those companies seeking added value through innovation.

JAN JAMBON
Minister-president of the Government of Flanders,
Flemish Minister for Foreign Affairs, Culture, ICT and
Facility Management

To further boost our innovation ecosystem, a close cooperation between government, knowledge institutes, businesses and citizens is required.

In my policy note 2019-2024, I have therefore set out to adopt the new innovation model which is known as the quadruple helix model which ties together the aforementioned actors.

This publication sets out the main initiatives and actors through which we connect with the four helixes. It presents a profound overview of the results of Flemish policy on science, technology and innovation in Flanders. It is clear Flanders possesses all the means to get the most out of the quadruple helix.

JO BROUNS
Flemish Minister for Economy, Innovation, Work, Social Economy and Agriculture

© Belga

JOHAN HANSSENS
Secretary-General
Department of
Economy, Science
& Innovation

FOREWORD

The Department of Economy, Science and Innovation of the Flemish Government is pleased to present its seventh edition of the "STI in Flanders". The aim is to present in-depth information about Science, Technology and Innovation policy in Flanders, highlight important figures and indicators, describe the research and innovation landscape, and present an overview of the main actors active in the field of R&D&I. This publication is updated on a regular basis. We are happy we can build on the previous work of our colleague Niko Geerts who offered us many details on the STI-landscape in Flanders in the earlier editions of this publication.

The Government of Flanders is aware of **the importance of research** and innovation as a necessary condition for maintaining wealth and well-being in Flanders. As early as the mid-1990s, it started to elaborate a broad-based STI policy, which has since been developed through a whole series of initiatives, treaties, parliament acts, decrees, agreements, decisions, MoU's and statements, which strive towards a common goal or seek to achieve other legislative measures that shape, implement and evaluate policy in the broad field of science, research and innovation. This is underpinned **by a substantial public budget for research and innovation.**

In 2023, the overall budget of the Flemish Government amounted to 61.6 billion euro. The budget (across all policy areas) for science and innovation policy of the Flemish Government reached 4.273 billion euro, of which 2.149 billion euro for R&D in the strict definition. In addition to this Flemish budget, research and innovation actors in Flanders annually have at their disposal about 330 million euro from federal budgets and 192 million euro from the EU Horizon 2020 programme. Hence, the total public budget for R&D (in a strict sense) available in 2023 to the various R&D actors in Flanders was 2.67 billion euro.

Furthermore, total expenditure on R&D from all (public and private) actors jointly (GERD) reached 10.861 billion euro in 2021. This represents for the Flemish Region an R&D-intensity of **3.65%** (2021). If the R&D-efforts from Flemish institutes located in the Brussels Capital Region are included, the (Flemish Community) R&D-intensity reaches **3.74%** (2021). The Regional Innovation Scoreboard (RIS) 2023 ranks the Flemish Region in the top group of "innovation"leader"; it is ranked with a 27th position in the list of EU (sub-) regions.

The Flemish Government committed itself in its 2019-2024 government coalition agreement **to reach the 3% target of R&D intensity by 2024.** This commitment was translated into 195 million euro one-off investments in R&D-infrastructure during this period, and an increase of 180 million euro in the annual R&I-budget. This comes on top of a 500 million euro increase in the annual budget during the previous five year government period. Based on the Eurostat statistics Flanders reached the objectives already in 2019 (3.35%) and will continue its investments the following years to stay well above the 3% target.

The government also steps up its efforts **to implement the quadruple helix model**, in which various stakeholders from government, business organisations, STI actors in Flanders and civil society join forces to develop initiatives, set policy targets, or maintain important efforts for the long term in the field of R&D and innovation. Another important characteristic of the policy for the coming years, is a more mission oriented policy. All these efforts should bring Flanders in the top 5 innovative regions, as ranked by the EU Regional Innovation Scoreboard.

This "STI in Flanders" publication provides an **overview of Science, Technology and Innovation policy and organisations in Flanders** aimed at a broad public. It bundles various types of information on policy, institutes, as well as different statistical data of the broad Flemish R&D&I landscape. After a first general chapter on the political and economic context of Flanders, you are guided through the landscape according to the quadruple helix model.

I wish you a pleasant reading of this sixth edition of "STI in Flanders"!

This "STI in Flanders" publication provides an overview of Science, Technology and Innovation policy and organisations in Flanders aimed at a broad public.

TABLE OF CONTENTS

CHAPTER 6

INTERNATIONAL ACTIVITIES 92

ANNEX I

BELGIAN INSTITUTIONAL CONTEXT 108

ANNEX II

MAIN R&D&I ACTORS 114

ANNEX III

FUNDING OF R&D 122

2024 IS A PIVOTAL YEAR FOR FLANDERS

2024 will see a series of political elections: European, federal, regional and local. Against this backdrop, Belgium (and Flanders!) will take up the presidency of the Council of the European Union during the first half of 2024. In the same period, the current Government's last grand project, Flanders Technology and Innovation, will reach cruising speed.

FLANDERS AT THE HELM OF THE EU

UNDERSTANDING THE EUROPEAN PRESIDENCY

From 1 January to the 30 June 2024, **Belgium will chair the Council of the European Union.** The Presidency of the Council rotates among the EU member states every 6 months. During this period, it plays a leading role in the work of the Council of the European Union and acts as an honest and neutral mediator to ensure continuity of the EU agenda, legislative processes and cooperation among member states. The Presidency has two main tasks: planning and chairing meetings in the Council and its preparatory bodies and representing the Council in relations with the other EU institutions. Belgium, together with Spain and Hungary, forms a Trio Presidency that formulates medium-term objectives and develops a relatively limited Joint programme.

FLANDERS, REPRESENTING BELGIUM, CHAIRS THE COMPETITIVENESS COUNCIL ON INDUSTRY

During the Belgian Presidency of the Council of the EU, Flanders plays an important role. The division of competences in Belgium between the federal government and the regions and communities also applies at EU level (i.e. in foro interno, in foro externo). During the EU presidency, Flanders will represent Belgium in the areas of youth, culture, audiovisual media, fisheries and industry. More specifically, Flemish Minister for Economy, Innovation, Work, Social Economy and Agriculture, Jo Brouns, will represent Belgium during the Presidency of the Competitiveness Council on industry.

The Competitiveness Council works to enhance competitiveness and increase growth in the EU. It deals with four major policy areas: internal market, industry, research and innovation and space.

© MEDIALIFE.BE

A PACKED AGENDA

The Belgian presidency will face a particularly busy schedule, managing its own priorities while also addressing 'carry-over' files such as the Net-Zero Industry Act and the Critical Raw Materials Act, aiming to bring them to completion.

Situated just before the European Parliament elections in June 2024, Belgium holds the unique position of being the final presidency under the current Commission. This provides an opportunity to review the EU's recent achievements and set the stage for future initiatives. Belgium intends to draft Council conclusions to guide the incoming Commission's efforts.

Flanders will not only shape EU industry policy but also steer EU-wide legislative processes and foster greater cooperation among member states.

EWI PRESIDENCY CALENDAR
2024

JAN

Opening Event 'Zie ons doen'
Mechelen
Saterday 6 January

FEB

Research to Reality: Digital Solutions to European Challenges LEAD
The EGG, Brussels
Monday 5 February - Tuesday 6 February

Bridging the Funding Gap (PMV)
Bozar, Brussels
Monday 5 February

Informal Council Competitiveness LEAD
Thor Park, Genk
Thursday 8 - Friday 9 February

Informal Council Research
Dolce La Hulpe, Brussels
Wednesday 14 February - Thursday 15 February

Ministerial Dialogue on principles and values for international cooperation in research and innovation
Résidence Palace, Brussels
Thursday 15 - Friday 16 February

Research Perspectives on the Health Impacts of Climate Change
Charlemagne building, Brussels
Monday 19 feb - Tuesday 20 February

HLG COMPCRO
Brussels
Thursday 22 February

MRT

European Mission Forum LEAD
Hendrik Consciencegebouw, Brussels
Wednesday 6 March - Thursday 7 March

Open Food Conference CO-LEAD
Provinciehuis, Leuven
Monday 11 March - Wednesday 13 March

Do we really need Science Communication? (FWO)
Paleis Der Academiën, Brussels
Tuesday 12 March - Wednesday 13 March

Formal Council Competitiveness
Europagebouw, Brussels
Tuesday 12 March - Wednesday 13 March

EuroHPC Summit Week
A Room With A Zoo, Antwerp
Monday 18 March - Thursday 21 March

Innovation Procurement Conference LEAD
Tour & Taxis, Brussels
Tuesday 19 March - Wednesday 20 March

APR

ERAC Conference
Namen
Thursday 11 April - Friday 12 April

HLG COMPCRO
Brussels
Thursday 11 April

APR

EOSC & OS Policies event CO-LEAD
Paleis Der Academiën, Brussels
Tuesday 16 April

Circular Economy Event CO-LEAD
The Square, Brussels
Wednesday 17 April

Marie-Sklodowska-Curie Conference 2024 CO-LEAD
WCCM + Mundaneum, Bergen
Thursday 18 April - Friday 19 April

Successful reconversion and sustainable transformation of a former mining region (LRM)
Terhills, Maasmechelen
Friday 19 April

Security Research Conference
Charleroi
Tuesday 30 April

MAY

Cluster 2 evidence-informed policy making CO-LEAD
Afrika Museum, Tervuren
Thursday 2 May - Friday 3 May

Informal HLG COMPCRO
Mechelen
Tuesday 7 May - Wednesday 8 May

Europe united against old and new pandemics LEAD
A Room With A Zoo, Antwerp
Tuesday 14 May - Wednesday 15 May

Formal Council Competitiveness
Europagebouw , Brussels
Thursday 23 May - Friday 24 May

The convergence of technologies enabling R&I for the healthcare of the future LEAD
The EGG, Brussels
Tuesday 28 May - Wednesday 29 May

JUN

INDTECH Conference
Namen
Monday 3 June - Wednesday 5 June

ESFRI Forum
Brussel
Tuesday 4 June t/m Friday 7 June

Informal Attaché meeting Research
Spa
Wednesday 12 June - Friday 14 June

Informal Attaché meeting Industry LEAD
Gent
Monday 17 June - Tuesday 18 June

https://www.ewi-vlaanderen.be/en/events

PRIORITIES FOR A FUTURE-PROOF EUROPEAN INDUSTRY

In a time of global shifts toward sustainability and digitization, Europe's industrial landscape is at a crossroads. The EU's updated 2021 industrial strategy aims to navigate these complexities, focusing on carbon neutrality, resource efficiency, and digital adoption, among other challenges. With the U.S.'s recent Inflation Reduction Act, the EU faces mounting pressure to respond to global protectionist measures. It is crucial for the EU to balance its green and digital ambitions with the need to protect European industries, as global actions have direct repercussions on the Union's competitiveness.

THE GREEN TRANSITION: A FOCUS ON CIRCULAR ECONOMY

In its upcoming European Council Presidency, Belgium intends to focus on circular economy as a cornerstone of the green transition. A diverse set of related issues—like bio-economy, circular manufacturing, and hydrogen use—will be explored in the context of specific industries, such as textiles or construction.

DIGITAL TRANSFORMATION: BRIDGING THE GAP BETWEEN SUSTAINABILITY AND TECHNOLOGICAL PROGRESS

Belgium and Flanders emphasize the interconnection between sustainability and digital transformation as part of its European Council Presidency agenda. Key to this approach is supporting companies, especially SMEs, in digital adoption and workforce upskilling and reskilling. European Digital Innovation Hubs serve as vital links between EU objectives and regional ecosystems. Belgium will host the event 'From Research to Reality: Digital Solutions to European Challenges' in Brussels on 5 and 6 February 2024, focusing on the intersection of Horizon Europe and the Digital Europe Programme. The event aims to foster high-level policy dialogue and stakeholder networking, setting the stage for future policy directions.

© Shutterstock

ADDRESSING STRATEGIC DEPENDENCIES

The issue of reducing strategic dependencies has long been a focal point of the EU's policy discussions, although up until now, only isolated initiatives have been deployed to tackle this complex challenge. Recognizing this gap, Belgium aims to look into a more holistic strategy focused on achieving open strategic autonomy. This comprehensive approach should attempt to capture the overarching implications of dependency issues. The theme of reducing strategic dependencies will be integrated across multiple policy dossiers. In particular, it will influence the driving forces behind both the green transition and digital transformation. For example, reducing reliance on critical raw materials and fossil fuels is essential not just for maintaining an open economy but also for advancing toward a more sustainable and digitally proficient future.

THE ECOSYSTEM APPROACH

Building upon Belgium's longstanding support for an ecosystem and value chain approach in European industrial policy, this focus will be intensified during the upcoming presidency. The goal is to enrich existing ecosystem frameworks and foster more resilient, interconnected value chains, aligning with the overarching objectives of the European Union.

THE EU TOOLBOX & INNOVATION-BASED PROCUREMENT

Belgium aims to assess the EU's current industrial strategy toolbox, focusing on its effectiveness in supporting innovative SMEs. Among these support instruments are IPCEI, InvestEU, and the European Innovation Council. The new strategy for technology infrastructures, due by the end of 2023, aims to smooth the transfer of knowledge from research to production. Additionally, the role of 'innovation-based procurement' will be reevaluated, with Flanders already ahead in implementing this approach. A dedicated event, one of many to be held under auspices of the Presidency across its priorities, will dive deep into the untapped potential of innovation procurement, showcasing a benchmark analysis and encouraging knowledge exchange. Flanders' established policy framework in this area will also feature prominently, underscoring its influence in Belgium's EU agenda.

Belgium and Flanders emphasize the interconnection between sustainability and digital transformation as part of its European Council Presidency agenda.

www.belgium24.eu

www.flanders.be/eu2024

@belgiumEU

belgiumineu

#EU2024BE

#EUvoorzitterschap2024

#EU2024Flanders

LOOK AT US GO: OPENING EVENT OF THE EU PRESIDENCY IN FLANDERS

Together we make Europe shine. That is the starting point of the opening spectacle on Saturday, January 6 in host city Mechelen. Count on an inspiring program packed with home-grown talent that young and old will thoroughly enjoy.

This event is also the kick-off of a campaign about the EU presidency that shows the influence Europe has on our daily lives. In the coming months, the spotlight will be on Flemish people who realize fantastic projects that also resonate in Europe. This way we focus on what Flanders does best; making Europe shine.

LOOK AT US GO
Together we make Europe shine


© Shutterstock

© FTI VLAANDEREN

FLANDERS TECHNOLOGY AND INNOVATION

The government of Flanders launched Flanders Technology & Innovation (FTI) in October 2022. The intention is to bridge the gap between Flanders' cutting-edge technology, which is highly regarded internationally, and segments of the population who have a gloomy outlook on the future. Government, companies, knowledge centres and citizens will focus on six domains:

1) Energy transition, 2) health care, 3) lifelong learning, 4) data 5) mobility and 6) media and entertainment.

The FTI acronym has been used before in Flanders and is a householdname for generations. The FTI technology fairs, which took place between 1984 and 1999, were an inspiration to many and the launching platform for knowledge centers such as imec and VIB.

With the new Flanders Technology and Innovation, the government of Flanders is now launching a contemporary project and a promotional campaign on innovation and technology.

The Flemish Government is convinced that technology can generate progress and therefore there is ample room for optimism. With the slogan, 'Welcome to Domorrow' ('Welkom in de Doekomst'), the Flemish Government is referring to the need for real solutions to major issues, and making Flanders the laboratory of Europe in the process.

FIRST TECHNOLOGY FAIR IN 2024

The countdown is on to Friday 15 March 2024, the kick-off for Flanders Technology & Innovation at the all-new Winter Circus in Ghent. Ten days of events will continue during the massive innovation and inspiration festival in six cities: Antwerp, Brussels, Ghent, Hasselt, Kortrijk and Leuven.

FTI is also buzzing in numerous Flemish companies, schools and universities. One of the highlights is the Open Technology & Innovation Day on 17 March 2024. This is when technology organisations can put themselves in the spotlight for the general public, applicants and technology enthusiasts.

The inspiring festival week will conclude on Saturday 23 and Sunday 24 March with a closing festival in the city of Antwerp for the general public.

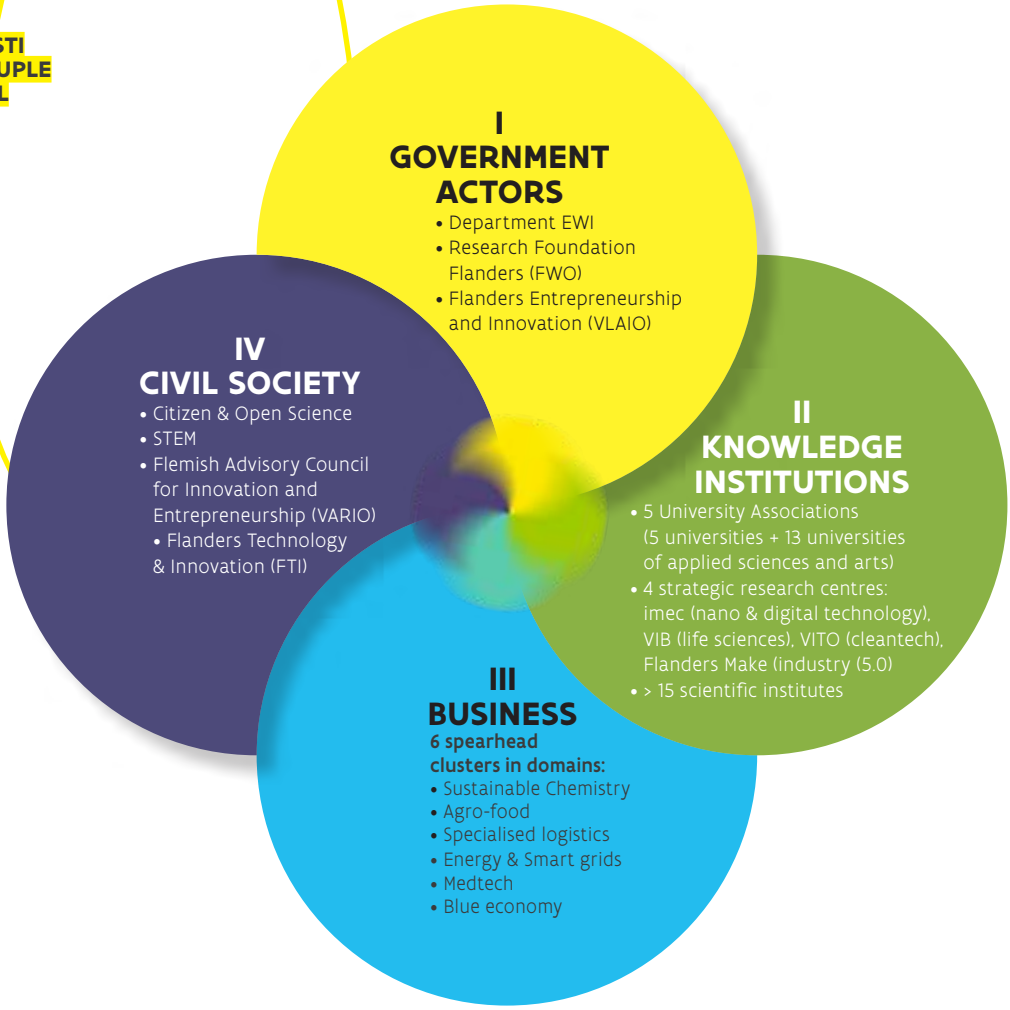
https://fti.vlaanderen

EXECUTIVE SUMMARY

This publication "Science, Technology and Innovation in Flanders" (or "STI in Flanders" in short) aims to give you an in-depth overview of the Flemish landscape resulting from Flanders' STI-policy. In contrast to previous editions, this edition has been built up along the lines of the quadruple helix model. An introductory chapter on the various contexts in which one has to situate Flanders is followed by chapters on government, research organisations, enterprises and citizens. The annexes provide you with overviews and more in-depth information.

FLANDERS' STI IN A QUADRUPLE HELIX MODEL

Figure 1



CHAPTER 1 explains how Flanders is the largest region in Belgium. As such it is a central region in Europe and part of a prosperous economic area referred to as the Blue Banana. Flanders is a tertiarised economy. The tertiary sector stands for 73.1% of gross value added and 77.7% of employment in 2023. Flanders and Belgium are ranked respectively as innovation leader and strong innovator in EU rankings.

Flanders, as a political entity, is a combination of a "region" and a "community" each adding their own competencies. in terms of legislation and budget, scientific research is mainly a community competence, whereas innovation is almost completely a regional competence. As a consequence of the strongly devolved Belgian state structure, it is not possible to speak about one Belgian research and innovation system, but rather multiple R&I-systems.

The chapter concludes with an overview of economic and combined technological-economical specialisation profiles based on relative specialisations patterns.

CHAPTER 2 brings the spotlight on government actors and focuses in particular, but not exclusively, on the Flemish policy area Economy, Science and Innovation (EWI), in charge of scientific research and innovation. It consists of a department that prepares, monitors, evaluates and reports on public policy in the field of enterprise (economic support and entrepreneurship), science and innovation; a council for policy advice (VARIO); and a number of agencies that are charged with the implementation of the policy decisions. These include the Research Foundation Flanders (FWO), Flanders Innovation & Entrepreneurship (VLAIO), Participation Company Flanders (PMV) and Limburg Reconversion Company (LRM).

This chapter also sheds light on the general orientations of the Flemish STI policy. The Flemish Government committed itself in its 2019-2024 government coalition agreement to reach the 3% target of R&D intensity by 2024. This commitment was translated into 195 million euro one-off investments in R&D-infrastructure during this period, and an increase of 180 million euro in the annual R&I-budget. The government will also focus on the continued implementation of the quadruple helix model and gear towards a more mission oriented policy. In 2019 alone, under the previous government agreement, the annual budget for R&D&I was increased with 280 million euro. This chapter highlights initiatives that were financed with this increase, such as the ones related to artificial intelligence (32 million euro per year), cybersecurity (20 million per year) and the Moonshot CO2 (20 million euro per year). Furthermore, this chapter explains how the smart specialisation strategy of Flanders is the product of the STI-landscape characterised by a combination of bottom up programmes complemented with 10 focal points. In addition, information is given on publications and reports where one can find monitoring and reporting of the R&D&I-policy.

CHAPTER 3 highlights the research organisations, commencing with the five university associations and their universities (Antwerp, Brussels, Ghent, Leuven, Hasselt). It also provides more information on their funding sources. Moreover, all information relating to on-going research conducted at the Flemish universities can be consulted via the Flanders Research Information Space research portal (FRIS) by browsing through the database using several search options (by research projects, organisations or persons) at www.researchportal.be.

© Marine Biology UGent

A second group of key research actors are the strategic research centres, of which Flanders has four. Imec (Interuniversity Microelectronics Centre) is a world-leading research and innovation hub in nanoelectronics and digital technologies, employing around 4,000 researchers. It creates disruptive innovation in application domains such as healthcare, smart cities and mobility, logistics and manufacturing, energy and education. The Flemish Institute for Biotechnology (VIB) is an independent research institute where some 1,700 top scientists from Belgium and abroad conduct pioneering basic research in domains such as brain & disease research, cancer biology, microbiology, molecular neurology or inflammation research. The Flemish Institute for Technological Research is an independent research centre in the area of cleantech and sustainable development. Lastly, Flanders Make is the Flemish strategic research centre that aims at stimulating product and production innovation in the Flemish manufacturing industry, thus supporting the further digital transition towards Industry 5.0 and (consequently) further strengthening the international competitiveness of the Flemish manufacturing industry.

This chapter further gives information on the main research infrastructures, an overview of collective research centres supporting different economic sectors, information on cooperation amongst research organisations and with businesses (technology transfer), the international activities from STI-actors and how this is supported by the government. The chapter concludes with the performance of institutions in a selection of well-known international rankings..

CHAPTER 4 focuses on enterprises. They are of major importance within the STI system in Flanders. 77% of R&D in Flanders was funded by the business enterprise sector in 2021 (BERD of 2.67%). However, even though a group of high-technology SMEs has arisen in recent years and continues to grow steadily, innovation efforts are still largely concentrated in certain industrial sectors and large companies.

The competitiveness of the Flemish economy is strengthened amongst other by stimulating cooperation between companies and between companies and knowledge centres. One very important instrument in this regard is the cluster policy. Flanders has six large-scale spearhead clusters: Catalisti (sustainable chemistry), Flanders' Food (agro-food), Flanders Logistics Cluster, Flux50 (energy), the Blue Cluster (sea-related activities) and Medvia Flanders (personalised medicine). Apart from support for the spearhead clusters, several instruments are in place to support research-business links, such as mandates allowing researchers to perform business-oriented research in

close relation with enterprises, initiatives on collective research, knowledge diffusion and living labs.

CHAPTER 5 relays information on initiatives towards the fourth helix, citizens. Important efforts are made as regards science communication, through science information actors (e.g. Technopolis), media actors and science festivals. Since 2018 a yearly call for Citizen Science project proposals is launched.

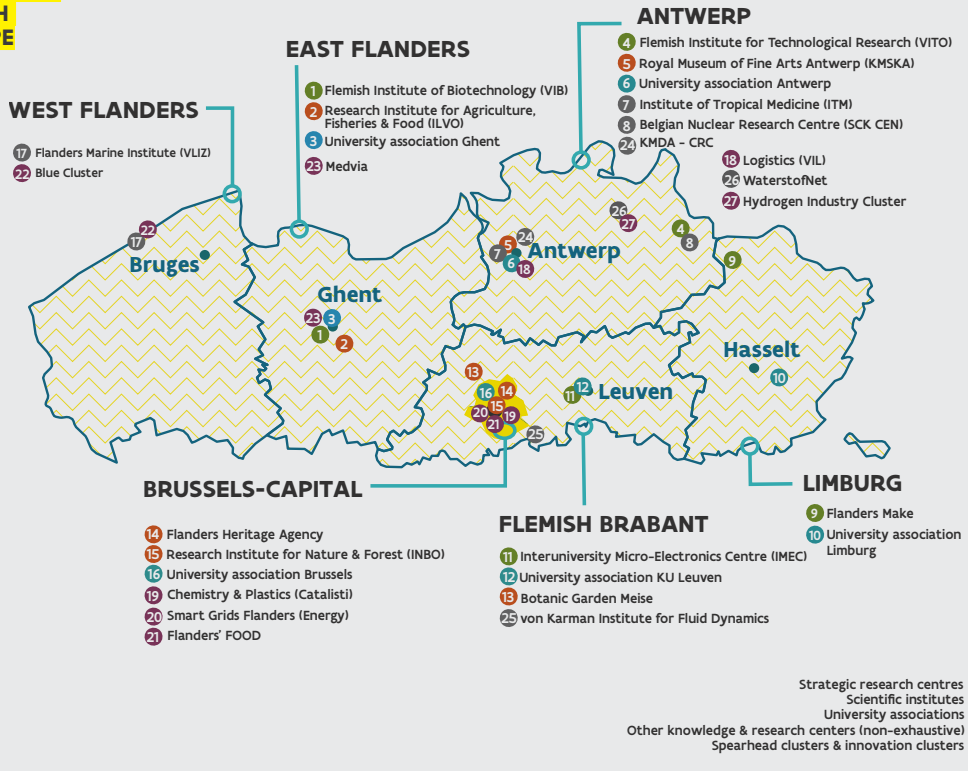
Attracting more people towards STEM-careers remains a challenge for Flanders. A STEM Action Plan 2012-2020 was developed, which was extended to 2030 under the current government. Lastly, initiatives are developed to make science careers more attractive.

Finally, **CHAPTER 6** takes a look at the internationalisation aspects of the Flemish STI-landscape. As an entity competent for both domestic as international affairs regarding its competences, Flanders has built a strong track record on the European and international level.

The first focus of Flanders is the European Union. The policy area EWI plays an important role at the EU level, both in terms of policy preparation (taking part in negotiations between Member States) as well as policy implementation (EU Framework for Research and Innovation, COSME, EU Regional Policy…). This part gives an extensive overview of European and international initiatives in which Flanders or Flemish research actors participate and provides information on the Vanguard Initiative, an inter-regional network of 32 regions that was initiated by Flanders. Besides the European Union, initiatives are also rolled out in the bilateral and other international field. Apart from the Department of Economy, Science and Innovation, important actors are the Flemish Department of Foreign Affairs as well as Flanders Investment and Trade.

MAIN RESEARCH AND ECONOMIC ACTORS IN THE FLEMISH STI-LANDSCAPE

Figure 2



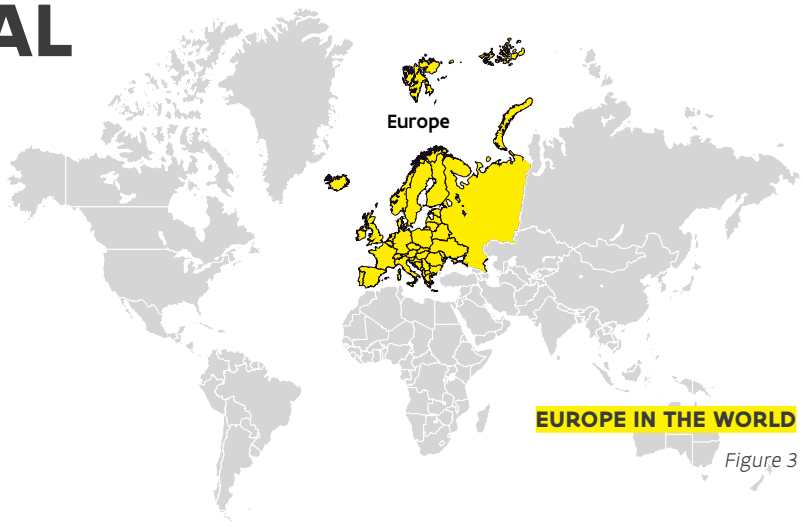
CHAPTER 1

FLANDERS: INNOVATION HUB IN THE HEART OF EUROPE

1

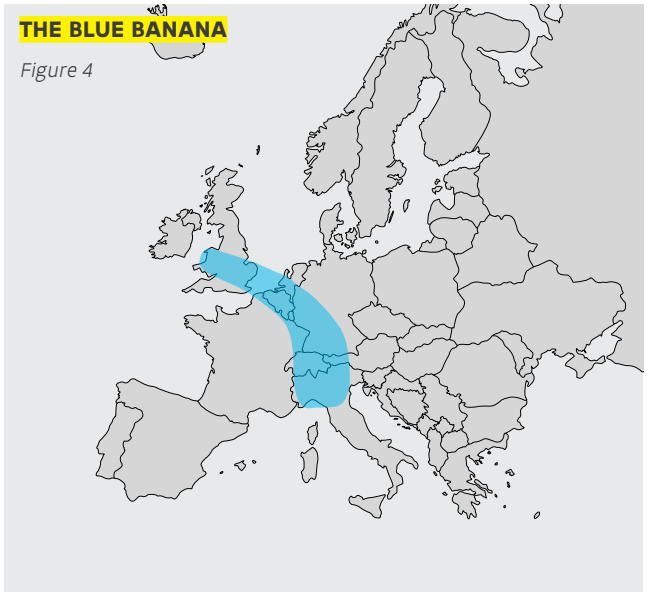
GEOGRAPHICAL CONTEXT

Flanders is situated on the European continent. Centrally located within the European Union, it is the northern region of Belgium.



EUROPE IN THE WORLD

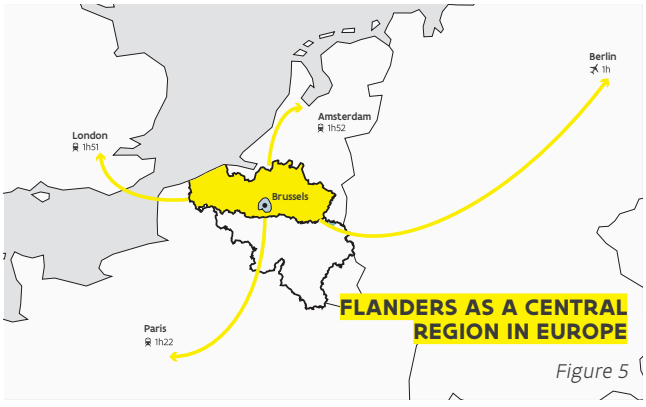
Figure 3



THE BLUE BANANA

Figure 4

Flanders is part of the area that is sometimes referred to as **the Blue Banana.** This area runs from the north of Italy to the United Kingdom over (parts of) Switzerland, Austria, Germany, France, Luxembourg, Belgium and the Netherlands. It is a series of densely populated urban areas responsible for a substantial part of the economic added value within the European Union.



FLANDERS AS A CENTRAL REGION IN EUROPE

Figure 5

Belgium's **neighbouring countries** are the Netherlands, Germany, Luxembourg and France. The North Sea forms a natural border with the United Kingdom.

2 INSTITUTIONAL CONTEXT: DIVISION OF R&D&I COMPETENCIES IN THE BELGIAN FEDERATION

While certain policy areas remain exclusively federal (e.g., defence policy, monetary policy, nuclear power research), other domains have largely or even completely been transferred to either the Communities or the Regions. The latter is the case for the Science, Technology and Innovation (STI) domain: **in terms of legislation and budget, scientific research is mainly a community competence, whereas innovation is almost completely a regional competence**. In Belgium, almost 80% of the total public R&D&I support is managed by the Communities and Regions. Flanders counts for 57% of all Belgian public R&D support (2022). The overall policy budget of Flanders now adds up to 61.6 billion euro of which 4.273 billion euro aimed at scientific research and innovation (2023i).

The **federal authority** remains responsible for a limited number of research programmes (notably in the field of climate and sustainable development), the support of research infrastructures of national interest, several federal scientific institutes, and a small number of exclusively attributed research themes, including the Belgian space policy, 'sustainable' nuclear energy and polar research at the Antarctic station. In addition, framework conditions such as IPR, normalisation, standardisation, tax credits and scientific visas for researchers also are exclusively managed by the federal authority. Tax credits aimed at R&D have become very substantial in Belgium in recent years. There is the so-called patent box (a lower tax rate on profits from a company's own innovation), a fiscal exemption of salaries' social contribution for R&D employees at research/scientific institutes and companies in Belgium, a tax credit for investments in patents and R&D-assets, and a tax exemption for regional subsidies.

As a consequence of this state structure, it is not possible to speak about one Belgian research and innovation system. Given the almost complete autonomy of the regions to set up their own system, there are rather **three R&I-systems** (two large and one small) that compete and cooperate with one another, pretty much like the different R&I-systems of the EU Member States do.

The various activities and policy instruments that Flanders deploys in the field of science, research and innovation, can be divided into the following categories:

2.1 DIRECT SUPPORT FOR R&D&I IN THE BROAD SENSE

This includes:

- **subsidies** or other support channels for basic, fundamental, cutting-edge and applied research that is conducted by researchers at universities, institutes, companies, knowledge networks, etc.;
- all **business-oriented support** (e.g., technology transfer, technology advice, technology scans, networking, dissemination of innovation, knowledge and technology, valorisation or research results, feasibility studies, knowledge vouchers, etc.);
- various forms of **collective research** (joint industry-science research, innovative networks, clustering);
- **promotion and popularisation of STI** (in education, society, business, science centres, etc.), mobility of researchers, etc.

2.2 RESEARCH RELATED TO THE COMMUNITY

This includes:

- broad **innovation policy**, as well as scientific research policy (fundamental, applied and strategic basic research);
- (research at) **higher education institutions** (universities of applied sciences and arts, universities);
- (research at) **public research organisations** (PROs);
- (research at) **scientific institutes and policy research centres** of the Flemish Community;
- (research at) **various institutes** that generate knowledge or scientific output;
- **infrastructure** in the field of research and innovation (small, medium-scale and large-scale research infrastructure, such as supercomputers, data collections, networks, clean rooms, etc.);
- **science parks, technology parks, incubator sites**, etc.;
- **policy research** for the fields for which Flanders is responsible: economic support, industrial policy, entrepreneurship, social economy, public works, employment, environment, nature conservation, forestry, agriculture, energy (except for nuclear energy), heritage, (primary, secondary and higher) education, water management, transport, vocational training, health, culture, tourism, care, health and well-being, data transmission, sports, media, youth, etc.

2.3 ACCESS TO FINANCE

Support for start-ups, spin-offs, participations, seed capital, risk capital, guarantees, fast-growing or technology-oriented businesses, business angels, loans, etc.

© Gorodenkoff

3

SOCIO-ECONOMIC, TECHNOLOGICAL AND SCIENTIFIC CONTEXT

Flanders' **population** accounts for about 58% of Belgium's total population, whilst its surface area covers about 44% of the country. The major part of the companies and the active population of Belgium are in its northern region, which also has a higher employment rate.

As a result, the **economy of Flanders** represents about 59% of the Belgian economy (as measured in GDP). It is also a very open economy: According to the ESA 2010 methodology Flemish exports of goods and services accounted for 106.3% of its GDP in 2021 (partly due to the 'transition' effect and the 'gate' (harbour) effect). On the other hand, the relative wealth of Flanders - as measured in GDP per capita - is about 20% higher than the EU-27 average. The small Brussels Capital Region causes a major "capital city" effect, with its strong presence of company headquarters and public administrations. If the wealth generated by the daily commuters from Flanders into the Brussels Capital Region were attributed to their residence in the Flemish Region, the Flemish GDP per capita would rise to 29% above the EU27 average. Total expenditure on R&D (GERD) in Flanders, which reaches almost 10.82 billion euro (3.65% of Flemish GDP), equates to over 63% of the Belgium total (2021) and the Flemish R&D intensity exceeds the national value for Belgium (for details see Annex III).

KEY FIGURES ON FLANDERS (FLEMISH REGION), BELGIUM AND EU-27

Table 1

	YEAR	UNIT	FLANDERS	BELGIUM	EU-27
SURFACE AREA		km^2	**13,521**	30,528	4,272,773
POPULATION	1/1/2023	million	**6.77**	11.52	447.96
GDP IN CURRENT PRICES	2021	billion euro	**296.1**	502.3	14,582.979
EXPORT	2021	billion euro	**317**	436	3176
GERD	2021	billion euro	**10,816**	17,235	331,032
GDP PER CAPITA (PPS)	2021	euro	**39,956**	39,059	32,517
R&D INTENSITY	2021	%	**3.65**	3.43	2.16
ANNUAL PUBLIC BUDGET FOR R&D&I FOR FLANDERS, (OF WHICH PUBLIC BUDGET FOR R&D IN STRICT SENSE)**, BY FUNDING AUTHORITY:**	2023	million euro	**4,845** (2,671)		
FLEMISH AUTHORITY:			**4,273** (2,149)		
FEDERAL AUTHORITY:			**330** (330)		
EU / HORIZON 2020:			**192** (192)		
EU / ERDF + INTERREG:			**50** (0)		
EMPLOYMENT RATE (% OF THE 20-64 YEARS OF AGE)	2021	%	**75.6**	70	72.7

	YEAR	UNIT	FLANDERS
ANNUAL PUBLIC BUDGET FOR R&D, (IN STRICT SENSE)**, BY FUNDING AUTHORITY:**	2022	million euro	**2,404.87** (0.74%)
FLEMISH AUTHORITY:			**2,081.08** (0.64%)
FEDERAL AUTHORITY:			**323.79** (0.10%)

The following table provides an overview of the weight of the main branches in the economy of the EU-27 and Flanders.

SHARE OF THE MAIN BRANCHES (AND CERTAIN SUB-BRANCHES) IN GROSS VALUE ADDED AND IN EMPLOYMENT IN THE EU-27 AND FLANDERS, 2023, %

Table 2

	GROSS VA		EMPLOYMENT	
	EU-27	FLANDERS	EU-27	FLANDERS
PRIMARY SECTOR	**1.8%**	**0.9%**	**4%**	**1%**
SECONDARY SECTOR	**25.6%**	**25.9%**	**23.80%**	**21.40%**
INDUSTRY (WITHOUT CONSTRUCTION)	20.2%	19.6%	17.9%	15.4%
CONSTRUCTION	5.4%	6.3%	5.8%	5.8%
TERTIARY SECTOR	**71.2%**	**73.1%**	**72.2%**	**77.70%**
TRADE, TRANSPORT, ACCOMMODATION AND FOOD SERVICE ACTIVITIES	18.4%	19.6%	24.5%	22.3%
INFORMATION AND COMMUNICATION	5.5%	4.4%	3.0%	2.9%
PROFESSIONAL, SCIENTIFIC, TECHNICAL, ADMINISTRATIVE AND SUPPORT ACTIVITIES	11.3%	16.7%	11.9%	16.5%
TOTAL	**100%**	**100%**	**100%**	**100%**
HIGH-TECHNOLOGY MANUFACTURING	2.4%*	2.3%*	1.1%	1.3%
MEDIUM HIGH-TECHNOLOGY MANUFACTURING	6.1%*	5.7%*	5.1%	3.9%
LOW AND MEDIUM LOW-TECHNOLOGY MANUFACTURING	6.4%*	8.8%*	10.1%	9.2%
TOTAL KNOWLEDGE-INTENSIVE SERVICES	39.8%*	42.2%*	39.0%	46.3%
KNOWLEDGE-INTENSIVE HIGH-TECHNOLOGY SERVICES	5.2%*	4.0%*	3.0%	3.7%
TOTAL LESS KNOWLEDGE-INTENSIVE SERVICES	35.0%	33.9%	31.1%	30.0%

Data year 2020 (provisional); For high-Technology and knowledge-intensive services: share of non-financial business economy (B-N_x_K_S95).

Data for EU-27 is no longer available after that year.

Source: Regional Accounts (NBB), Eurostat and OECD (2023)

The most important tertiary sectors in Flanders are 'trade & repair', 'consultancy & testing', 'real estate' (only according to gross value added), 'administrative and support services' (mainly according to employment), 'education' and 'transportation & storage'.

Flanders' share of the secondary sector is 25.9% in gross value added and 21.4% in employment. The relatively greater importance of the secondary sector in gross value added than in employment is an indication of its overall greater labour productivity, due to a greater exposure to international competition by trade, and the higher capital investment in these sectors. The main branches, apart from 'construction' are 'food & beverages', 'chemicals' (mainly according to gross value added) and Pharmaceuticals.

Eurostat provides a classification of the technology intensity of industry and the knowledge intensive services. Flanders has a significantly higher share of knowledge intensive services compared to the EU-27, but performes worse than the EU-27 average for medium high-technology manufacturing and knowledge intensive high-technology services.

.

3.1 PERFORMANCE OF BELGIUM AND/ OR FLANDERS IN INTERNATIONAL PERSPECTIVE

Belgium and/or Flanders are listed in several EU or other international rankings based on (several) R&D&I criteria or indicators. The main indexes are:

3.1.1 EUROPEAN INNOVATION SCOREBOARD, EIS 2023

In the 2023 edition, Belgium is ranked again in the first group of 'innovation leaders'. In previous editions Since 2021 Belgium is ranked IN the first group 'strong innovators' and as the 5th EU member state overall in the EIS 2023 edition.

Strong increases since 2016 are: government support for business R&D, sales of innovative products and public-private co-publications. Strong decreases since 2016 are foreign doctorate students, innovative SMEs collaborating with others and most cited publications.

In terms of indicators, Belgium scores remarkably better than the EU-27 average (=100%) for the following indicators: 'Population with tertiary education (154.3%)', 'Foreign doctorate students (189.7%)', 'Government support for business R&D (176%) 'Enterprises providing ICT training (160.9%)', 'business process innovators (157.0%)', Innovative SMEs collaborating with others (223.6%), 'Public-private co-publications (265.2%)', 'Employment in innovative enterprises (161.4%), 'R&D expenditures in the business sector (153.5%), and 'International scientific co-publications (180.4%)'.

Compared to 2016, Belgium has improved its score more than the average EU-score.

3.1.2 REGIONAL INNOVATION SCOREBOARD, RIS, 2023, FROM THE EC

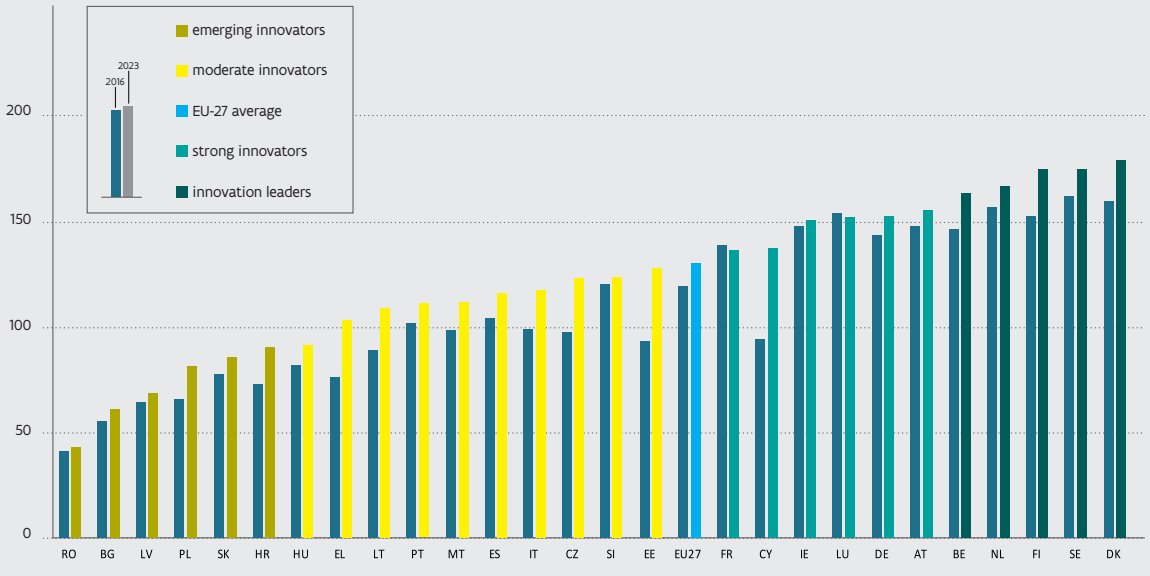
Flanders is a '**leader - innovator**' (= performance > 125% of the EU average), like some other EU regions such as London (UK), South East (UK), Utrecht (NL), Noord-Holland (NL), Hamburg (DE), Köln (DE), Ostschweiz (CH), Oslo og Viken (NO) and Ile de France (FR). Overall in the EU (ranking of 239 regions) Flanders ranks 23th whereas the two other Belgian regions rank 27th (Brussels Capital Region - 'innovation leader') and (Walloon Region 60th - 'strong innovator').

However, it is important to note that the RIS ranks a combination of regions both at the NUTS1 and the NUTS2 level. If the Flemish provinces (NUTS2) would be considered separately, as is done fore.g. the Netherlands or Germany, the resulting score would differ.

The RIS for Flanders shows that relative strengths compared to the EU are in the categories of "Innovative SMEs collaborating with others", "Business process innovators", " Innovation expenditures per person employed", "Most)cited scientific publications"', 'Product innovators", "Most cited scientific publications", "International scientific co- publications", "Tertiary education" and "Employment innovative enterprises" and "Public-private co-publications". It scores weaker for "Design applications" and "Trademark applications". The difference with the Belgian average is very limited indeed, which is evident because the Belgian figure and data consist for the largest part of the Flemish data therein.

EUROPEAN INNOVATION SCOREBOARD (2016 AND 2023)

Figure 6



3.1.3
GLOBAL INNOVATION INDEX, GII 2023

The GII considers Belgium ranks 23th for input and 22th for output.

Notable strengths are 'education', 'knowledge workers', 'GERD' and 'school life expectancy'.

For 10 indicators it reaches the **top 10 of the world**: education, school life excpectancy, researchers (FTE/population), GERD (%GDP), logistics performance, finance for startups and scaleups, knowledge workers, GERD performed by business (%GDP), GERD financed by business (%GDP), Females employed in advanced degrees, University-industry R&D collaboration, GERD financed by abroad (%GDP), research talent (% in business).

3.1.4
COMMUNITY INNOVATION SURVEY, CIS, 2021

The CIS contains a broad set of indicators on innovation activities of enterprises and provides information on environmental benefits due to innovation.

With a score of 75% (versus 68% for Belgium) Flanders ranked first during the period 2018-2020 in the list of the highest proportion of enterprises with innovation activity (product innovations, business process innovations and/or ongoing or abandoned innovation activities), Flanders is ranked among the top countries Greece (73%), Norway (70%), Germany and Finland (both 69%). The EU average is 53% of enterprises of 10 employees or more that reported innovation activity during the period 2018-2020.

3.2
FOCUSING ON STRENGTHS AND "SPEARHEAD DOMAINS"

The **relative specialisation index** can be a useful indication to map the specialisation structure of the science, innovation and economy system, which in turn can be a starting point for the future potential for smart specialisation. This index compares the distribution of activities in science production, technology production, economic performance from a region or a country with the average distribution of the same type of activities in the whole of Europe (or the world). The statistics on respectively the scientific publications, patents and exports are used as proxies for these kinds of activities that can be considered as successive steps in the innovation trajectory, from idea to market. A more than average share of these suggests a specialisation in that specific domain.

3.2.1
SCIENTIFIC SPECIALISATIONS

The scientific specialisation pattern of Flanders is rather **typical for a mature economy with a long tradition in scientific research that covers the whole spectrum**. The Flemish profile is similar to that of most Western countries, with life sciences and medical sciences as the dominant publications areas.

Annex VI provides more details on the scientific publication performance (as well as on the citations and co-publications) and contains a spider web display that benchmarks Flanders to the world standard.

3.2.2
TECHNOLOGICAL SPECIALISATIONS

This section considers the technological specialisation pattern of Flanders. The RTAN index (Relative Technological Advantage Normalized Index) is used for mapping technological specialisation. It is based on a breakdown of EPO patents in 35 technology domains (ISI, Fraunhofer Gesellschaft). Patent data provide an insight in technological progression since they represent an indicator that is used to get a picture of the innovation degree within an organisation, region or innovation system. The index represents the share of a given technology domain in the Flemish patent portfolio, compared to the share of that technology domain in the patent portfolio of a reference group: EU-15, US, Canada, Switzerland, Japan and South-Korea.

An RTAN index between -1 and 0 implies relative under specialisation in Flanders, an index between 0 and +1 implies that Flanders is specialised in that domain.

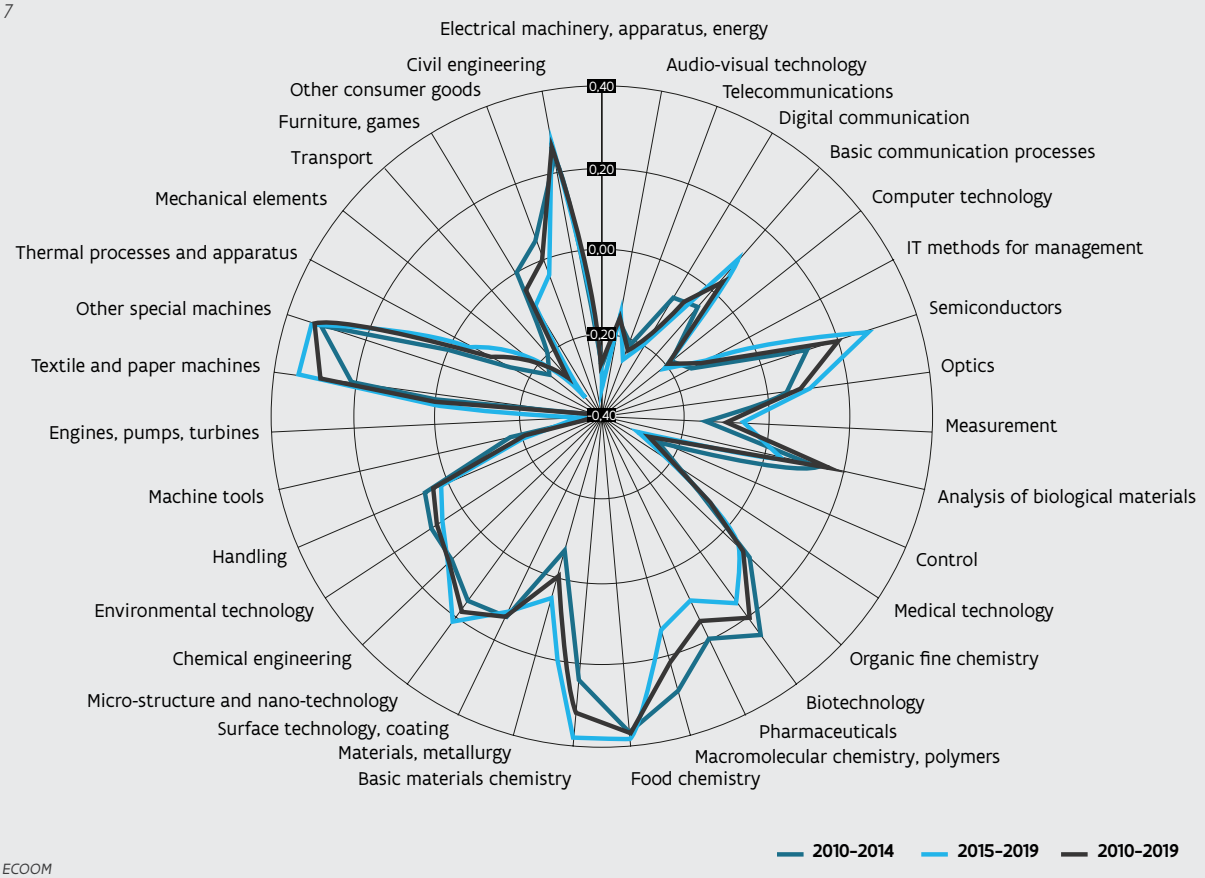
The radar graph (see Figure 7) reveals that Flanders has a relatively strong technological specialisation in chemical domains (e.g. basic materials chemistry, food chemistry, macromolecular chemistry, polymers), as well as biotechnology and pharmaceuticals, although specialisation in the latter ones has been decreasing over the considered time period. Further Flemish specialisations are semiconductors, textiles and paper machinery and Other specialised machinery, all of which have been increasing over the considered period; as well as - but to a lesser extent - microstructures and nanotechnology.

This specialisation is driven on the one hand by several Flemish companies with strong in-house R&D in sectors such as machinery/mechatronics, foods and particularly pharmaceutics (which is the largest high- technology sector in Flanders). On the other hand, these specialisations also reflect the activity of the different Flemish strategic research institutes: nanotechnology (IMEC), biotechnology (VIB), materials and energy (VITO) and specialised research departments at the five universities of the Flemish Community (see page chapter 3).

Flanders represents about two thirds of the total Belgian patent portfolio, whereby 82% of patent activity is accounted for by private companies (see Figure 7).

TECHNOLOGICAL SPECIALISATION (RTAN) OF FLANDERS BASED ON THE EPO PATENTS, 2010-2014, 2015-2019 EN 2010-2019, INDEX BETWEEN -1 AND +1.

Figure 7



Source: ECOOM

For the calculation of the RCA values the NACE export value information of the following reference countries en regio were used: Flanders, Belgium, Austria, Denemark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal, Spain, Sweden and United Kingdom, US, Canada, Switzerland, Japan and South-Korea .

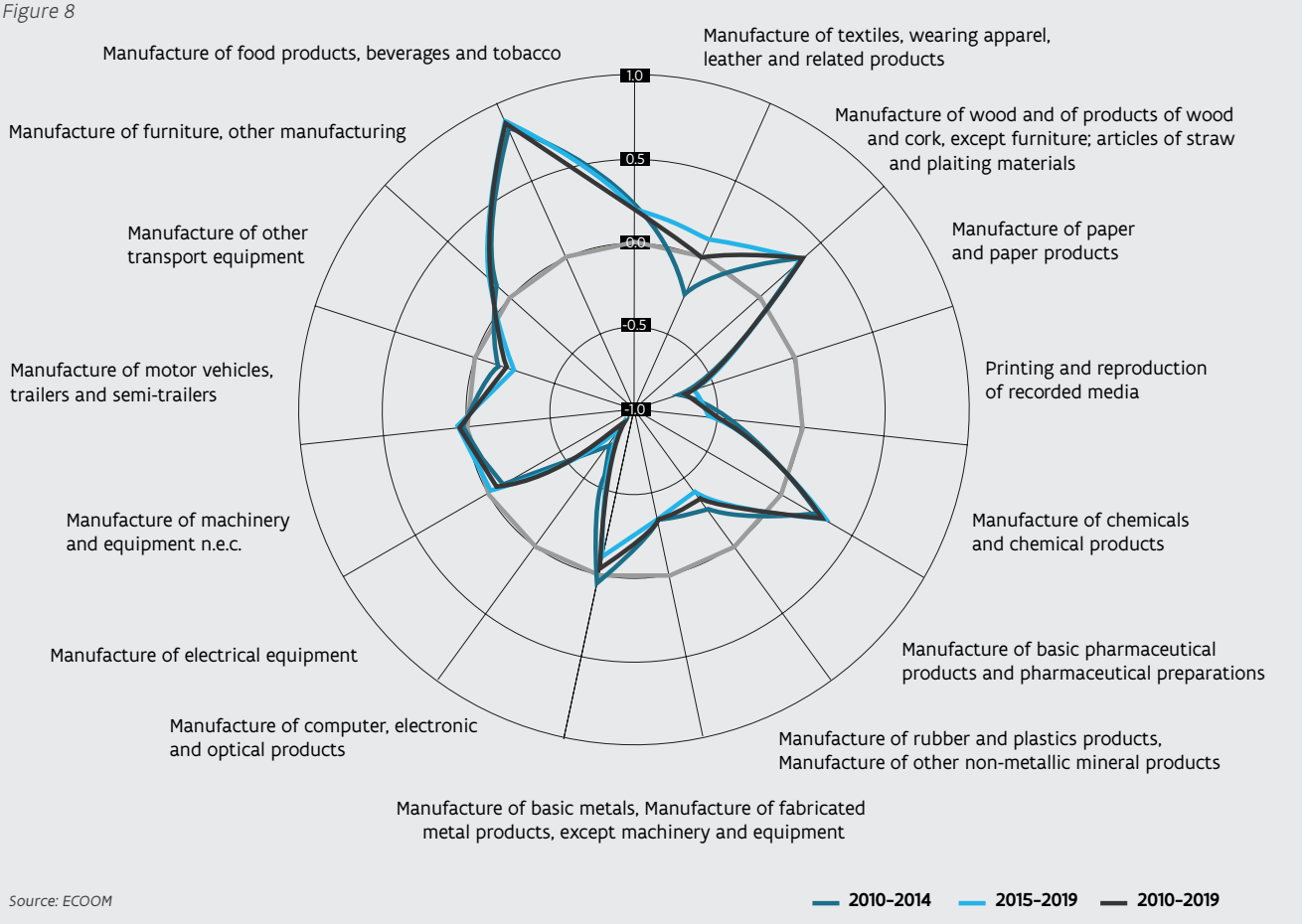
3.2.3
ECONOMIC SPECIALISATIONS

To establish the degree of economic specialisation, the Revealed Comparative Advantage (RCA) is used. It benchmarks the breakdown of Flemish export in sectors (NACE) to the sectoral breakdown of export in a set of reference regions and countries. The figures reveal a very strong specialisation of Flanders in printing and reproduction of recorded media and strong specialisations in the **manufacture of chemicals** and chemical products and **manufacture of food products, beverages and tobacco.** The specialisation in **manufacture of basic metals** and fabricated metal products, as well as **manufacture of wood and of products of wood and cork** is somewhat lower but still positive These are usually sectors that are closely linked to the intermediate position of Flanders in international value chains, whereby Flanders represents a link to larger economies, in particular Germany. In addition, Flanders is relatively specialised in a "traditional" sector like food products: it is a very important industrial sector in terms of employment with a wide set of specialisations such as pork meat, frozen vegetables and potatoes, etc. The economic specialisation patterns of Flanders has remained stable over the considered time period, with the exception of the manufacture of basic pharmaceutical products and pharmaceutical preparations, which has evolved from being relatively under specialised to a neutral degree of specialisation in Flanders.

The economic specialisation pattern of Flanders (see Figure 8) reflects that of a mature and (still) highly diversified economy.

ECONOMIC SPECIALISATION (RCAN) PATTERN OF FLANDERS BASED ON THE RELATIVE EXPORT SHARES, 2010-2014, 2015-2019 EN 2010-2019, INDEX BETWEEN -1 AND +1.

Figure 8



Source: ECOOM

NACE sector 19 (Manufacture of coke and refined petroleum products) were not included in the calculation. The reason is the missing export values for several EU-countries, whereby a distorted representation of the RCA values is created.

In most sectors, the Flemish economy has been able to maintain a critical mass and remain competitive, while the under-specialisation in some sectors is due to the conditions in Flanders (e.g. mining).

3.2.4 COMBINED TECHNOLOGICAL - ECONOMICAL SPECIALISATION PROFILES

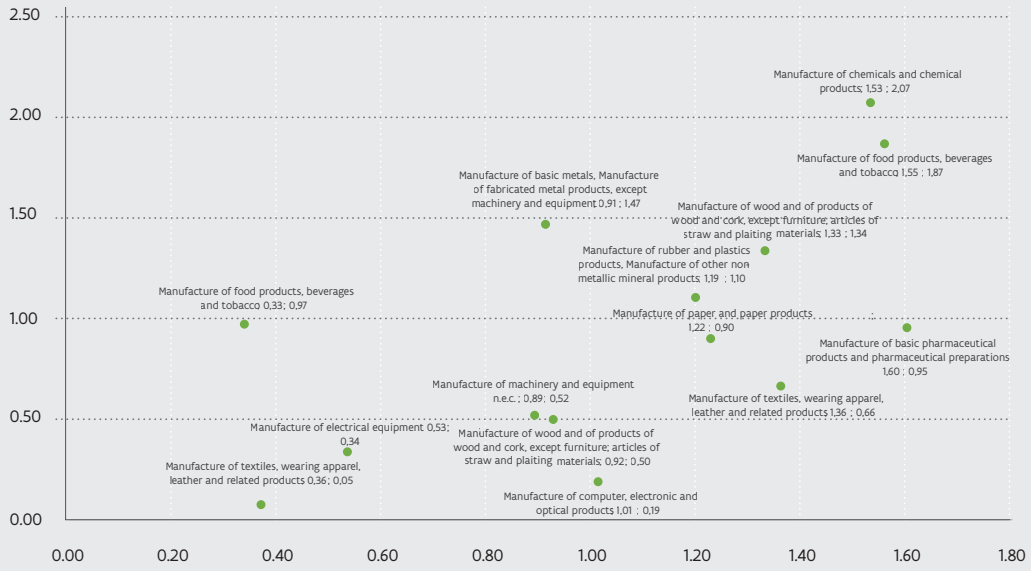
The coherence of specialisations in the subsequent stages of the innovation trajectory for a specific industry, from idea to (export) market, can be considered as competitive advantage of a region or country for this specific industry. However, the correspondence between these classifications is only partially assured, hence there is no direct match between science classifications and technology classifications. Between technology and economic classifications this matching has been achieved based on the so-called "Fraunhofer classification" of technology domains.

The figure below represents the alignment between technological (RTA) and economic (RCA) specialisation patterns in Flanders. For most domains, technological and economic specialisation are in line with one another. They are both high for 'Printing and reproduction of recorded media', 'Manufacture of food products, beverages and tobacco', 'Manufacture of chemicals and chemical products', 'Manufacture of wood and of products of wood and cork, except furniture; articles of straw and plaiting materials' and 'Manufacture of rubber and plastics products'. They are both low for 'Other transport equipment', 'Manufacture of machinery and equipment' and 'Manufacture of furniture, other manufacturing'.

For some domains however, technological specialisation in Flanders is not fully translated into economic specialisation: 'Manufacture of basic pharmaceuticals and pharmaceutical preparations', 'Manufacture of paper and paper products', 'Manufacture of textiles, wearing apparel, leather and related products' and 'Manufacture of computer, electronic and optical products'. On the other hand, for 'Manufacture of basic metals, manufacture of fabricated metal products, except machinery and equipment', a considerable economic specialisation in Flanders is not fully mimicked in the Flemish technological specialisation pattern.

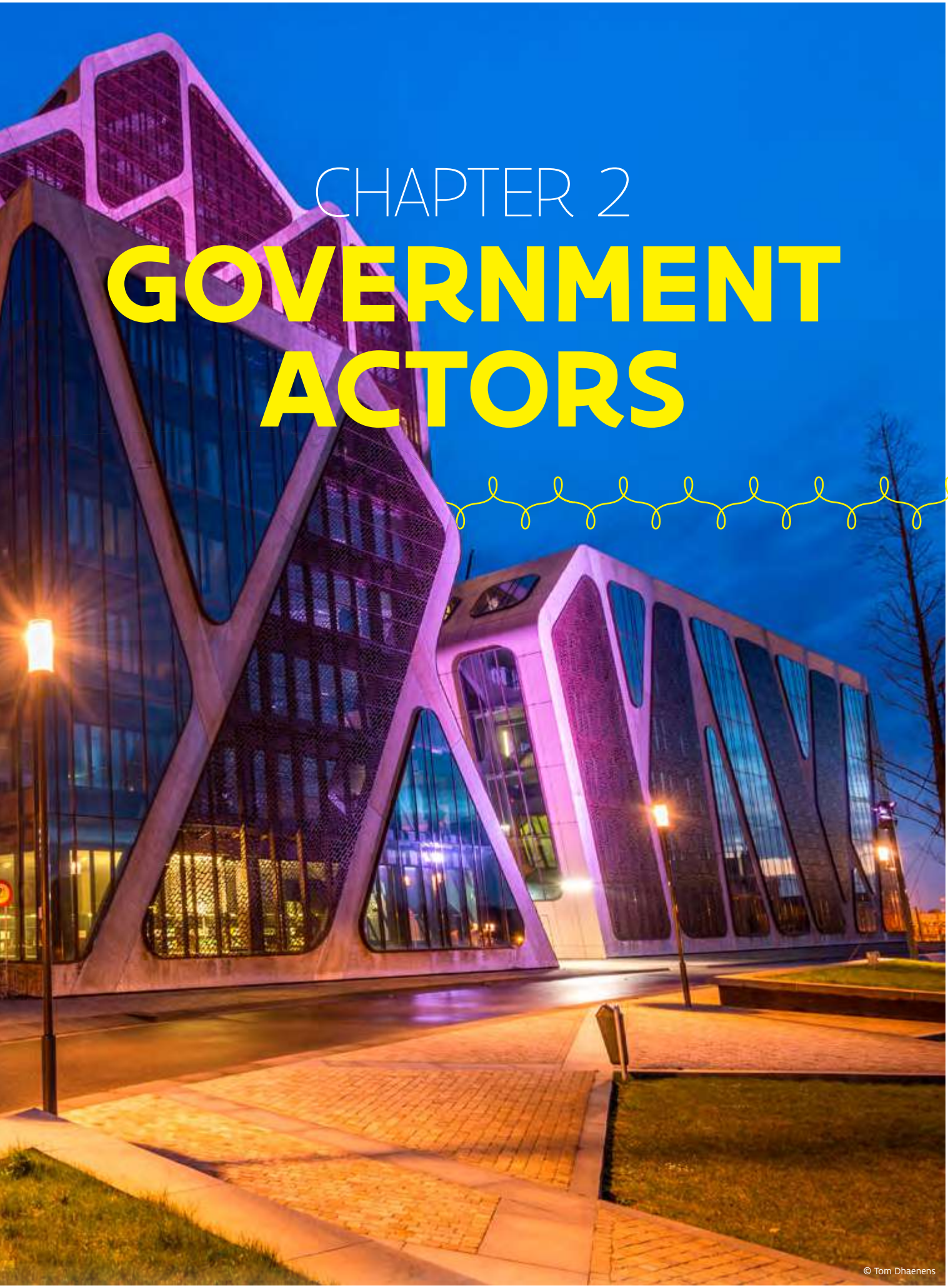
COMBINATION OF THE RELATIVE TECHNOLOGICAL SPECIALISATION PATTERNS (RTA) WITH THOSE FOR ECONOMIC SPECIALISATION (RCA) (2010-2019)

Figure 9



Source: ECOOM

For the calculation of the RCA values the NACE export value information of the following reference countries and regions were used: Flanders, Belgium, Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal, Spain, Sweden and United Kingdom NACE sector 19 (Manufacture of coke and refined petroleum products) were not included in the calculation. The reason is the missing export values for several EU-countries, whereby a distorted representation of the RCA values is created. NACE sector 18 (Printing and reproduction of recorded media) has the highest RTA and RCA values (2.57; 16.51). This sector were not included in the graph in order to visualize, more clearly, the other sectors.



CHAPTER 2

GOVERNMENT ACTORS

© Tom Dhaenens

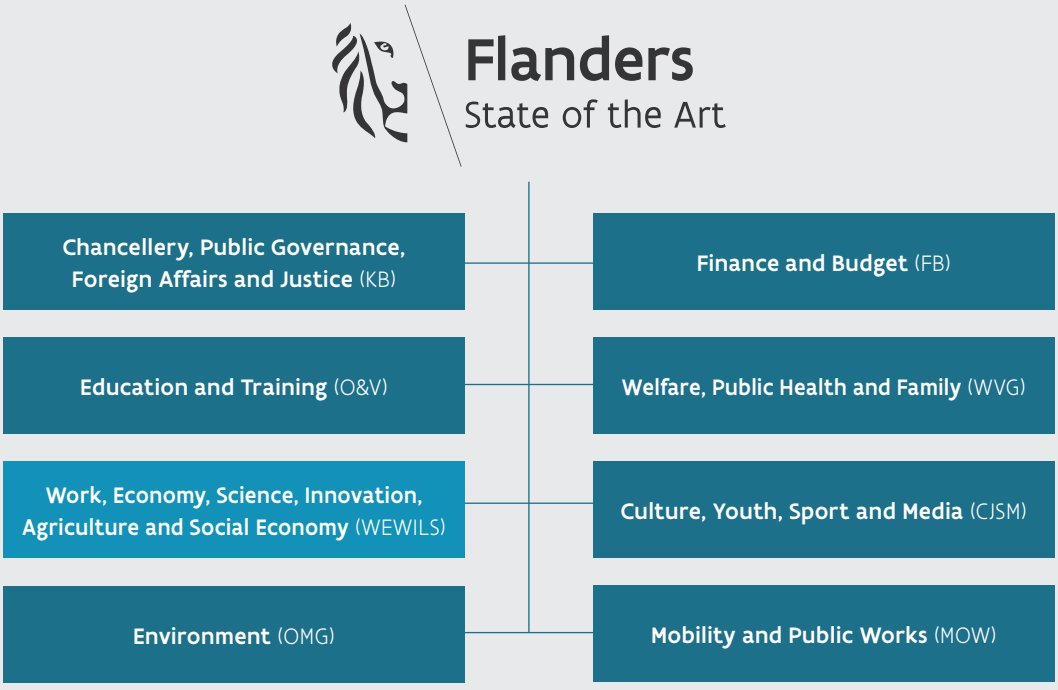
1 FLEMISH ADMINISTRATION

The Flemish administration comprises numerous public services, which are grouped in 8 policy areas as of 1 January 2024. Each policy area has one department and several agencies. The policy domain Work, Economy, Science, Innovation, Agriculture and Social Economy is a new policy domain since 1 January 2024.

It will have two departments (Economy, Science and Innovation, and Work and Social Economy) during a transitional period that will end with the merger of the two departments on 1st of January 2025.

THE 8 POLICY AREAS OF THE FLEMISH ADMINISTRATION

Figure 10



1.1 POLICY AREA ECONOMY, SCIENCE AND INNOVATION

At the governmental level a single **minister (Mr. Jo Brouns)** is responsible for both scientific research and innovation. The public authority charged with STI policy is the WEWILS policy-domain. WEWILS (= Werk, Economie, Wetenschap, Innovatie, Landbouw en Sociale economie) manages the broad field of Economy, Science and Innovation, together with the domains of Work, Social Economy and Agriculture. A department prepares, monitors, evaluates and reports on policy, while a few agencies execute and implement policy measures in the fields of scientific research, innovation, entrepreneurship and industrial policy.

Figure 11 represents the public bodies that are active in the WEWILS policy area as of 2024.

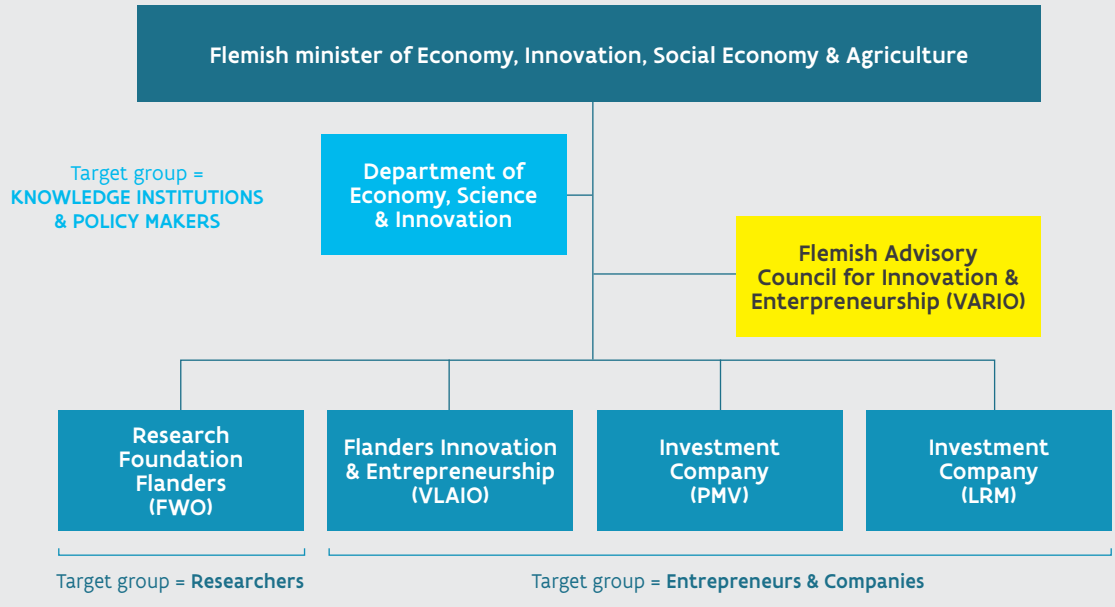
1.1.1 GOVERNMENT DEPARTMENT

The role of the department as regards STI is to **prepare, monitor, evaluate and report** on public policy in the field of enterprise (economic support and entrepreneurship), science and innovation, thereby contributing to greater wealth and well-being in Flanders. Its levers are the promotion of:

- excellence in scientific research;
- an attractive and sustainable business climate;
- a creative, innovative and entrepreneurial society.

ECONOMY, SCIENCE AND INNOVATION (EWI) POLICY AREA FROM THE FLEMISH GOVERNMENT, ANNO 2023

Figure 11



The **strategic aims** of the department regarding STI are:

- create a sustainable economic tissue and facilitate entrepreneurship;
- stimulate innovation and creativity;
- stimulate knowledge creation and knowledge valorisation;
- putting Flanders on the map internationally in the field of economy, science and innovation;
- develop itself as knowledge centre within the Flemish authority for delivering and use of insights in the field of economy, entrepreneurship, scientific research and innovation.

More specifically, **within the STI field**, the department:

- prepares all legislative initiatives or position papers in the field of science, research and innovation;
- promotes close co-operation between research institutions, higher education institutions and companies;
- prepares multi-annual management agreements with a number of organisations, such as the four Flemish strategic research centres, the Research Foundation Flanders (FWO), the Flanders Marine Institute (VLIZ)...;
- evaluates policy instruments and organisations that receive governmental and public support;
- coordinates all R&D&I topics, including the governance activities under the EU Framework Programme for R&I;
- has representatives in the General Representation of the Flemish Government to the EU (AAVREU) within the Permanent Representation of Belgium to the EU, who participate in working parties in the Council of the EU;
- participates in the high-level groups from the EC (ERAC, High-Level Group COMPCRO) and OECD (CSTP);
- monitors the execution of policy measures and reports on policy developments in the STI domain towards the Flemish, federal and international (mainly EU and OECD) policy level;
- holds responsibility for the direct implementation of several policy (support) instruments, specific on-off initiatives, participation fees or representational positions. Examples of these are: the support for the BOF (Special Research Fund), the IOF (Industrial Research Fund), and the PWO (Practice oriented scientific research at universities of applied sciences and arts), governmental representatives in strategic research centres or public knowledge organisations, membership fees e.g. of EMBRC (European Marine Biology Resource Centre).

1.1.2 POLICY ADVICE

The **'Vlaamse Adviesraad voor Innoveren en Ondernemen' (VARIO)**, the 'Flemish Advisory Council for Innovation and Enterpreneurship', advises the Flemish Government and the Flemish Parliament on its science, technology, innovation, industry and entrepreneurship policy. It is formally part of the policy area Economy, Science and Innovation. The council advises on its own initiative as well as on request. It works independently from the Flemish Government and the Flemish stakeholders in the field of science, innovation, industry and enterprise. The Council consists of ten experts from the scientific world and the business community, who take part in a personal capacity. VARIO publishes advisory reports and other reports, on a diverse range of relevant topics, which can be found on its website.

VARIO exists since 2017. Its predecessors were the 'Vlaamse Raad voor Wetenschap en Innovatie' (VRWI, or Flemish Council for Science and Innovation, 2010-2016) and the 'Vlaamse Raad voor Wetenschapsbeleid' (VRWB, or Flemish Science Policy Council, 1985-2009).

Policy advice on socio-economic themes is also formulated by the Social and Economic Council of Flanders (SERV), which is formally part of the policy area Public Governance and the Chancellery. In it are represented the various Flemish employer organisations and trade unions.

1.1.3 AGENCIES

Whereas the Flemish Government's departments prepare, monitor, evaluate and report on public policy, a number of **agencies are charged with the implementation of the policy decisions.** They make up four of the seven agencies that fall under the WEWILS policy area. The funding agencies have established a wide variety of initiatives and support instruments to implement R&D&I-policy. These agencies are:

- **FWO:** Research Foundation Flanders;
- **VLAIO:** Flanders Innovation and Entrepreneurship;
- **PMV:** Flemish Investment Company;
- **LRM:** Limburg Investment Company.

RESEARCH FOUNDATION FLANDERS (FWO)

The Research Foundation Flanders[1] (FWO) is the funding **agency that supports ground-breaking fundamental research, strategic research** and clinical scientific research in Flanders. The FWO also stimulates cooperation between the research institutes and promotes equal opportunity. Its main mission is to deepen knowledge about people and their environment. The FWO funds both excellent and promising researchers, as well as research projects, following an interinstitutional competition and an evaluation by national and international experts. The only criterion is the outstanding quality of the researcher and the research proposal. Researchers can apply for support from the FWO through a broad range of funding instruments.

A system of **peer review** by the international scientific community is used to assess all applications and scientific activity reports. To this end, the FWO has organized several scientific committees, including top researchers from Belgium and abroad. The FWO's scientific committees, called "FWO Experts Panels", are crucial to ensuring the excellence of FWO-funded activities. There are Expert Panels that are specialised committees for a specific scientific research discipline and there are interdisciplinary committees, which cover all the scientific research disciplines of Flemish concern. Each committee consists of several experts, the majority always being affiliated to a non-Flemish university.

The **main instruments** of the FWO are support to fellowships (PhD students, postdoctoral researchers, etc.) and to research (via grants and projects). Furthermore, extensive means are available for medium-scale and large-scale research infrastructure, the management of large computing capacity in Flanders, promoting international cooperation and mobility, including participation in multilateral initiatives or in international research facilities, such as CERN. Finally, the FWO also awards scientific prizes to distinguished researchers, often in collaboration with private companies.

Almost all instruments of the FWO are bottom-up oriented so candidates can freely apply with their own curiosity-driven research. Only a small fraction of the FWO instruments and budget has a mission-driven character.

1 In Dutch: Fonds voor Wetenschappelijk Onderzoek Vlaanderen

In 2023 there was an overall evaluation of the FWO. This evaluation assessed how FWO has fulfilled his mission and tasks during the Governing Agreement 2019-2023 and gives a potential direction to the new Governing Agreement between the FWO and the Flemish Government in 2024. This new Governing Agreement 2024-2028 will set out the strategic and operational goals for the coming period.

In this new period the FWO wants to become even more the house of science for each excellent researcher.

The overall part of the annual budget of the FWO is granted by the Flemish Government and amounts to approximately 407 million euro in total.

© FWO

FLANDERS INNOVATION & ENTREPRENEURSHIP (VLAIO)

Flanders Innovation & Entrepreneurship (VLAIO) is a government agency, charged with **implementing the economic, innovation and enterprise policy in Flanders**. It helps companies with the start-up of their activities, the growth and continuity of their business, but also with the search for the right location, information on permits, financing, investments in innovation and ecological technologies, and other topics. VLAIO also hosts the Enterprise Europe Network (EEN) Flanders, and acts as the managing authority for the EU ERDF calls and support in the Flemish Region. In short, VLAIO manages all economic and innovation support for companies located or active within the Flemish Region.

VLAIO was established in 2016 after a merger of the Agentschap Ondernemen (AO, Enterprise Flanders) with the Agentschap voor Innovatie door Wetenschap en Technologie (IWT, Agency for Innovation by Science and Technology). As of 2016, VLAIO acts as the **one-stop-shop for companies.**

In the field of innovation support, VLAIO assists companies, research centres and knowledge centres in realising their research and development projects, by offering funding, advice and a network of potential partners in Flanders and abroad. To achieve this, it has different types of instruments at its disposal:

- **Direct funding:** supporting the innovative projects of companies, research centres, collective research initiatives, organisations and individuals through assignments set by the Flemish Government;
- **Advice and services:** offering support to all Flemish SMEs and large companies and research centres by helping them with their applications or by providing technological advice during their innovative projects;
- **Co-ordination and networking:** stimulating cooperation by bringing innovative companies and research centres into contact with Flemish intermediate organisations that stimulate innovation; to this end, VLAIO manages a broad network of partner organisations and works closely with 'Team Bedrijfstrajecten'
- **Policy development:** supporting the Flemish Government in its innovation policy; e.g. by studying the effectiveness of the innovation initiatives and different support programmes.

VLAIO supports all types of innovators in Flanders:

- **Companies** that are actively innovating, from small start-ups to multinationals with a branch in Flanders; specific attention is paid to SMEs, although partnerships between companies and knowledge centres are also eligible for innovation support. As of 2016, VLAIO supports a number of spearhead clusters (see chapter 4);
- **Individual researchers and research centres** can apply to VLAIO for the appropriate support and can also receive funding, advice and contacts with potential partners for innovative scientific research, applied research and technology transfer;
- **Organisations of various types (e.g. collective research centres) that stimulate innovation** in Flanders can receive financial support.

The agency applies a **bottom-up approach**: subsidies and advice are typically awarded to initiatives proposed by the actors themselves and any project including a technological innovation component is eligible for funding. VLAIO continues to adapt its policy instruments to broaden and deepen the innovation trajectory, as well as adapting this trajectory to specific needs.

The support schemes are aimed at businesses (from SME's to large companies), research organisations, service-providing organisations, non-profit organisations, and individual persons. The main support instruments for innovation and R&D are:

- R&D business projects
- R&D feasibility studies
- Innovative start-ups support
- Interdisciplinary cooperative research projects (ICON)
- Baekeland mandates
- Innovation mandates
- COOCK (Projecten 'Collectief Onderzoek & Ontwikkeling en Collectieve Kennisverspreiding/-transfer')
- Support for cooperation and the dissemination of knowledge (TETRA, Agricultural Innovation Projects)
- Co-financing of international projects (ERA-Net, JTI, Eurostars, EUREKA)
- Spearhead clusters and cluster projects
- Living labs,

PARTICIPATION COMPANY FLANDERS (PMV)

As an investment company, PMV is building a sustainable Flemish economy, the engine of our prosperity and well-being. PMV is the partner of ambitious companies and projects, focusing on social impact and financial return. PMV finances promising companies from the very start, through to growth and internationalization. PMV offers tailor-made financial solutions to all entrepreneurs with a good business plan and a strong management team. It does so with capital, loans and guarantees. PMV also provides financing and expertise for the transition to sustainable energy, the reallocation of cultural-historical heritage, the investment in infrastructure and the efficient (re)use of space in Flanders. PMV is also functioning as the National Promotional Bank (NPB) for Flanders in the framework of the InvestEU programme.

PMV offers financial solutions through capital, loans or guarantees, or combination thereof. PMV provides venture capital – always in co-financing with the market – both at an early stage and to more mature companies. This may range from limited tickets – often in as convertible subordinated loans – to large capital tickets. PMV is different from many other capital providers. It has no pre-determined exit date and can therefore spend years working with companies to build their future. Moreover, it is an active but patient investor. PMV will try to meet the company's financing needs in the best possible way, taking into account both the company's needs and those of other stakeholders.

PMV raises capital for companies in various sectors, but has developed particular expertise in the Life Sciences & Care industry. For the latter, PMV focusses on pioneering innovations that offer scalable solutions with a strong ambition to strengthen the local ecosystem.

PMV also provide the Flemish Government with fudiciary management of some of its assets. One recent example is the Flanders Future Tech Fund (FFTF). This fund, set up in 2019 with an initial 75 million euro injection by the Flemish Government, is an early-stage financing fund that wants to meet the financing needs of early technology initiatives of research centres, universities and Flemish spearhead clusters, as well as private parties. Through its investments, the Flanders Future Techfund wants to focus on the valorization of technology developed by Flemish companies, with particular attention to the spearhead domains of Care & Welfare, Digital Transformation and Climate & Sustainability. The Flanders Future Techfund can provide financing from 0.5 to 5 million euros.

LIMBURG RECONVERSION COMPANY (LRM)

LRM is an investment company that **develops and stimulates economic growth in the Flemish province of Limburg**. LRM targets all sectors and companies, from starting companies to growing SMEs and larger businesses. LRM provides lending and venture capital to companies who are related to Limburg and is a catalyst for the transition of the Limburg manufacturing economy towards an innovative and technological economy. LRM is developing qualitative clusters within the spearhead sectors in Limburg. In addition, LRM develops infrastructure, such as campuses and incubators, and gives former mining sites a make-over. LRM focuses on the following four investment domains:

- Sustainable Societies;
- Health & Care;
- Smart Services & Manufacturing;
- Leisure & Heritage Experience

2 GENERAL ORIENTATIONS OF FLEMISH STI POLICY

2.1 POLICY DOCUMENTS IN THE FIELD OF R&D&I

Policy in the field of science, research and innovation is being implemented through a whole set of policy instruments (parliament acts, decrees, ministerial decisions, government communications, concept notes, MoU's...). The role and tasks of the major actors in the STI landscape of Flanders are defined in the "Decreet betreffende de organisatie en financiering van het wetenschaps- en innovatiebeleid" **(Flemish Parliament**

MEMBERS OF THE FLEMISH GOVERNMENT 2019-2024

© Belgaimage

Flemish Minister of Employment, Economy, Social Economy and Agriculture Jo Brouns, Flemish Minister for Youth, Media and Brussels Affairs Benjamin Dalle, Flemish Minister of Mobility, Public Work Lydia Peeters, Flemish Minister of Environment, Energy, Tourism and Justice Zuhal Demir, Flemish Minister of Welfare Hilde Crevits, Flemish Minister-President Jan Jambon, Flemish Minister of Education and Animal Welfare and Sports Ben Weyts, newly appointed Flemish Minister of Domestic Policy and Living Together Gwendolyn Rutten and Flemish Minister of Finance, Budget and Housing Matthias Diependaele pose for the photographer for a family portrait ahead of a Minister's council meeting of the Flemish Government at the Minister-President's offices, in Brussels, Friday 10 November 2023.

Act on the organisation and financing of the scientific and innovation policy), which was approved on 30 April 2009 by the Flemish Parliament (and modified thereafter).

The Government of Flanders elaborates its policy through several agreements, initiatives and statements, including:

- the **government coalition agreement** in which the various political parties that are part of the governing coalition outline their priorities for the five-yearly parliamentary term (currently 2019-2024);
- the **policy document of the minister** charged with scientific research and innovation for the five-year governing period 2019-2024 (note: this theme is a part of an overall policy document for Economy, Science and Innovation);
- the **annual policy letter of the minister**, which further elaborates and specifies the initiatives for the general policy framework that is announced in the policy document (note: this theme is a part of an overall policy letter for Economy, Science and Innovation);
- several **multi-annual strategic plans and targets** that are agreed with a broad-ranging group of stakeholders from government, civil society and industry. These plans set out targets across a range of policy fields, amongst which STI is assigned a clear priority. The major plans include the transversal policy document Flanders 2050 (VISIE 2050: a long-term strategy for Flanders) and Vizier 2030 (translation of the Sustainable Development Goals to the Flemish context). The Flemish Reform Programme for the Europe 2020 strategy (in the framework of the European Semester) recaps the main policy intentions of the government as elaborated in the aforementioned documents.

In its **government coalition agreement 2019-2024**, the Flemish Government stated the ambition to become one of the top 5 innovative knowledge regions in Europe, as measured by the Regional Innovation Scoreboard. International excellence remains the most important goal of its research policy, both in fundamental and applied research. The Flemish Government furthermore committed itself **to reach the 3% target of R&D intensity by 2024**.

This commitment was translated into 195 million euro one-off investments in R&D-infrastructure during this period, and an increase of 180 million euro in the annual R&I-budget.

The government also focused on the continued implementation of the quadruple helix model. The policy approach set out three strategic axes:

1. allowing enterprises to undertake, innovate and internationalise
2. invest further in favourable framework conditions for a strong R&D&I-system
3. invest further in the interaction between the actors of the R&D&I-system

For the period 2019-2024, the EWI policy field was part of the responsibility of the Flemish Minister for Economy, Innovation, Work, Social Economy and Agriculture, The policy priorities on scientific research and innovation were elaborated in the **policy document 2019-2024**. Six cross-cutting strategic ambitions were enumerated:

1. Allow local entrepreneurship to flourish
2. An integrated industrial policy for the future
3. Regional specialisation in regions and provinces
4. Successful enterprising in the digital society
5. Innovation for climate-neutral solutions in the industry
6. Sustainable growth through a knowledge driven circular economy

The realisation of these cross-cutting ambitions was supported by measures which are divided into the categories economy, scientific research, innovation, and science communication.

Apart from the aforementioned (further) implementation of the **quadruple helix model**, another main characteristic of the policy of the past years was the focus on a **more mission oriented policy**.

2.2 MORE RESOURCES FOR R&D

The Flemish Government set itself the ambition to invest 3% of its gross domestic product (GDP) in R&D by the end of government period 2019 - 2024. It achieved this by increasing the annual budget for R&I with 180 million EUR by 2024. It also allocated 195 million EUR in one-off investments in research infrastructure.

More information on funding of R&D can be found in Annex III.


© Shutterstock

2.3 THEMATIC POLICY PRIORITIES

2.3.1. RECOVERY PLAN FLEMISH RESILIENCE

In **2020**, responding to the COVID-19 crisis, the Flemish Government adopted a **4.3 billion euro recovery plan**, called Flemish Resilience. Of this sum, **over 500 million euro** was invested in economy, science and innovation.

The Flemish recovery plan allocated investments through five building blocks, namely government investments (1.5 billion euro), climate, sustainability and innovation (1.2 billion euro), digitalisation (800 million euro), people and society (655 million euro) and Brexit initiatives (83 million euro).

Of these investments, over 500 million euro are taking place within the policy domain economy, science and innovation. They are used to accelerate the necessary transition of the economy, in particular in the field of digital and climate. About half of this package is invested in hydrogen research and innovation (125 million euro), research infrastructure (115 million euro) and accelerating enterprise R&D-projects (100 million euro). Smaller investments are made in circular economy and construction (25 million euro), vibrant city centres (25 million euro), smart cities (20 million euro), bio-economy (10 million euro), media innovation (10 million euro), business parks (10 million euro), water security (10 million euro) and care and health (6 million euro), amongst others.

2.3.2 GRAND POLICY INITIATIVES

Since 2019, over 70 million euro per year is being invested in three grand policy initiatives relating to artificial intelligence, cybersecurity and climate change. These initiatives were adopted in March 2019. In 2020, the Flemish Government extended its efforts on transition to industrial climate neutrality through an additional programme.

POLICY PLAN ARTIFICIAL INTELLIGENCE

The policy plan Artificial Intelligence is aimed at **strengthening Flemish competitiveness by boosting the uptake of AI-technologies by enterprises**. At the same time, it also reinforces basic research in areas where Flanders has an edge over it competitors. Lastly, it aims to provide framework condition by focussing on ethics and legal aspects, as well as competences and skills.

The policy plan foresees an **annual investment of 32 million euro**. It is composed of three complementary pillars:

7. **Top strategic basic research** (12 million euro annually) for the targeted development of new knowledge, scientific breakthroughs and talent at world level. This part focuses on themes where Flanders already performs excellently and where synergy can be obtained with the demand-driven implementation agenda of the Flemish business community. The research programme is co-ordinated by imec (see page 58) and focuses on four challenges: (i) hybrid, automated, reliable and actionable data science ("data science"): the help to make complex decisions; (ii) real-time & energy-efficient AI: extracting and processing information at "the edge"; (iii) multi- agent, collaborative AI for autonomous interaction between decision-making entities; and (iv) human-like AI to communicate and collaborate seamlessly with people. These challenges are applied to use cases on efficient health care, future mobility, industry 5.0 and other topics.

8. **A central focus on the implementation of AI applications in businesses** (15 million euro annually). A demand-driven agenda from the business community must be brought to existing government instruments, mainly of the Flemish Agency for Innovation and Entrepreneurship (VLAIO, see chapter 2) and relevant institutions, through open, well-organized channels and networks.

9. **A strong supporting policy** (5 million euro annually) that, in addition to the significant training needs aimed at the labour market, also addresses the legal, ethical, democratic and socio-economic aspects of AI. The focus is on a correct yet ambitious outreach to the population, so that innovative technologies are not regarded merely as exogenous but rather as endogenous, reinforcing evolutions, in which Flemish actors can actively participate. Initiatives under this pillar include the Knowledge Centre Data & Society (to study the legal and ethical aspects of AI) and the Flemish AI-Academy (to tackle the skills mismatch on the labour market).

POLICY PLAN CYBERSECURITY

The Policy Plan Cybersecurity is set up in a similar way as the Policy Plan Artificial Intelligence, focussing on research, implementation and competences. It foresees an annual investment of 20 million euro. This plan also has three complementary pillars:

1. **Top strategic basic research** (8 million euro annually) to reinforce domains where Flanders is already at the forefront, such as cryptography and securing distributed systems. The research programme is carried out by a consortium of Flemish research institutions and focuses on four tracks: (i) secure software & applications; (ii) security services; (iii) system and infrastructure security; and (iv) security building blocks & secure hardware.

2. **A central focus on the implementation of cybersecurity applications in businesses** (9 million euro annually). VLAIO and its partner network supports companies in improving their digital readiness and raise their awareness of the importance of cybersecurity. There is also support for the concrete implementation of cybersecurity, amongst others by detecting the latest trends and technologies for different sectors in the Flemish economy so companies can adopt state-of-the-art technology.

3. **A strong supporting policy** (3 million euro annually) that focuses providing training and setting up a complementary awareness raising campagne. The aim is to raise awareness on the different security challenges for every Flemish enterprise. It also wants to make every citizen more aware on how to handle personal data and how to protect us in an increasingly online world.

MOONSHOT CO_2

In the coming twenty years, **Flanders will invest 20 million euros every year in innovation and research that can contribute to the Flemish climate targets.** The programme is referred to as a "moonshot", an ambitious investment to make a major technological leap. To tackle climate change, the industry in Flanders must fully focus on reducing CO_2 emissions, more CO_2 capture and CO_2 reuse. Breakthroughs in this area can, moreover, allow participating companies to play a pioneering role at international level and thus give Flanders a prime mover advantage.

Given the importance of chemical compounds, the spearhead cluster for the chemistry and plastics sector Catalisti (see Chapter 4) has been assigned a coordinating role. It is expected that also sectors such as construction, transport and agriculture will follow and think along.

CLIMATE LEAP (KLIMAATSPRONG)

In addition to the moonshot CO_2, which is aimed at research and innovation, the programme 'Klimaatsprong' (Climate Leap) was adopted in 2020. It aims at the transition of industrial companies to climate neutrality.

The objective of the programme 'Klimaatsprong' is to offer guidance to Flemish industrial companies in their transition to climate neutrality in line with European climate objectives and to ensure the future of these industries in Flanders.

To this end specific measures to facilitate the transition of industrial companies will be developed and implemented.

GRAND NEW POLICY INITIATIVES

GRAND POLICY INITIATIVES

POLICY PLAN
ARTIFICIAL INTELLIGENCE

strategic basic research	12 million euro
implementation in enterprises	15 million euro
supporting measures (skills, legal and ethical aspects, awareness raising)	5 million euro

an annual investment of 32 million euro

POLICY PLAN
CYBERSECURITY

strategic basic research	8 million euro
implementation in enterprises	9 million euro
supporting measures (skills, legal and ethical aspects, awareness raising)	3 million euro

an annual investment of 20 million euro

MOONSHOT CO_2

supporting innovations related to reducing CO_2-emissions and Carbon Capture and Usage	20 million euro

an annual investment of 20 million euro
for the next 20 years

HYDROGEN STRATEGY

Flanders aspires to become a European leader in the field of hydrogen and published a Flemish hydrogen vision and strategy "European frontrunner through sustainable innovation" in November 2020. Hydrogen plays an important role in our energy and climate transition and it creates economic opportunities for the many Flemish companies and technology players that are active throughout the hydrogen value chain. Hydrogen will be crucial for the decarbonisation of the Flemish industry for both industrial processes and as a feedstock for sustainable chemical products, and to further decarbonise our mobility sector. Large offshore windpower farms off the Flemish coast generate green electricity, which can be used for producing green hydrogen that can be stored and used later for multiple applications with no carbon emissions.

The Flemish hydrogen vision and strategy has two main overarching goals :

- Through Research and Innovation reinforce our Flemish industrial ecosystem, in view of positioning our technology providers in the European and global value chain of hydrogen technologies and systems (reinforce technological leadership)

- Support the implementation of hydrogen in our Flemish economy and society, in view of the sustainable transition of our industry and other societal sectors (e.g. mobility).

And in line with these goals five strategic objectives have been identified.

1. Supporting excellent research in hydrogen in Flanders knowledge centres (universities and strategic research centres).
2. Strengthening the industrial ecosystem in Flanders
3. Stimulating the use of hydrogen and the roll out of hydrogen technologies
4. Facilitate international partnerships
5. Establish favourable framework conditions for hydrogen

For more information on the Flemish hydrogen vision and strategy : https://www.ewi-vlaanderen.be/sites/default/files/bestanden/5fad5387b328e9000c00018b.pdf (in Dutch)

SECURITY AND DEFENCE

In the current geopolitical reality, several federal, European and international security and defence initiatives have been launched. Those initiatives and its projects bring about opportunities in research, development and innovation, as well as economic opportunities.

In order to contribute to our European security objectives and to reinforce Europe's technological and industrial defence base, we will leverage those initiatives. This can be achieved by informing, inspiring, supporting and assisting our stakeholders through various ways.

The Flemish Government has articulated an ambition to support its stakeholders working or willing to work in the defence industry and on defence research, reinforcing the technological and industrial base. We aim to collaborate on several federal, European and international security and defence initiatives. To that extent, the Flemish Government decided in 2023 to contribute to two NATO initiatives, namely the Defence Innovation Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund.

Our Flemish Minister for Economy, Science and Innovation also chairs the Consultation Group on Security and Defence to discuss several opportunities and needs of our Flemish Stakeholders in this domain. This groups consists of a triple helix constellation, meaning government, industry and academia being represented.

SPACE

The ambition for the space domain was included in the Flemish Coalition Agreement 2019-2024. In order to strengthen Flanders' position in the future at federal and European level, the 'Space Economy Impulse Program' has been installed.

The program focuses on four areas: attracting young talent, supporting competitiveness and entrepreneurship, providing R&D funding and science communication. The triple helix cluster initiative 'Flanders Space' coordinates the execution of the program and offers all possible opportunities to the Flemish actors such as companies, knowledge institutions, government and citizens.

They are given the opportunity to work with space data and infrastructure and develop applications and services relevant for Flanders. In addition to funding for feasibility studies, the development of prototypes, innovative technology and concepts, Flanders Space will focus on stimulating Flemish entrepreneurship in space, among other things by providing support to Flemish space start-ups. Also, by offering Frank De Winne (post)doctoral fellowships and internships, the program wants to offer STEM graduates an attractive opportunity to start a sustainable career in the Flemish space industry.

Finally, targeted communication actions highlight the achievements in this domain and demonstrate how space data and space infrastructure contribute to solving societal challenges.

The ambitious program, totaling € 11 million, puts space firmly on the map in Flanders.

In the current geopolitical reality, international security and defence initiatives create new opportunities for space related projects in research, development and innovation, as well as new economic opportunities.

BIOECONOMY

In 2020 the Flemish government launched the Bioeconomy policy plan, intended to strengthen the Flemish bioeconomy sector. The bioeconomy includes all economic activities that use organic material or biological processes. These activities are extremely diverse and belong to different sectors, such as agriculture and food production, waste processing, the chemical and pharmaceutical sector, energy and material production. These sectors in turn form the basis for essential green transitions in industrial sectors for food, consumer goods, construction or energy and water supply.

The policy plan gathers actions in research and innovation to pursue the further development of this sector. Since 2022, the activities have been divided between the research agenda for long-term developments, and the circular economy action plan for short term actions.

The bioeconomy research agenda has identified Flanders as one of the top regions in Europe for bioeconomy research.

- Microbiome for agriculture: The microbiome has various functions in agriculture, such as promotion of plant growth, helping to clean the environment and limiting the growth of harmful microbes.
- Climate adaptation and mitigation for agriculture : Climate adaptation is required to create a more sustainable and resilient agriculture.
- Sustainable and circular food chains: innovative solutions for circular food chains collaborate to transform and revalorize side and waste streams.
- Alternative crop protection: Alternative crop protection is aimed at reducing the use of chemicals pesticides. Alternatives are based on biological, physico-mechanic, and other non-chemical methods to control diseases, pests and weeds.
- Synthetic biology: The goal of synthetic biology is to understand and manipulate biological systems to develop new applications in different areas, such as agriculture, healthcare and industry.
- Microbiome for human health: The multiple functions of the microbiome make this field crucial for the development of safe and personalized healthcare.

These six domains are both highly strategic development areas for a future green industry and agriculture, and they correspond closely to strong clusters of scientific excellence in Flanders.

The circular economy action plan for bioeconomy brings together a large community of public and private actors to develop pathways for concrete actions.

The action areas for this plan have been collectively defined as :

- The development of new biohubs
- The development of a new biofibre sector
- Biobased building and living
- Carbon management in soil
- Production of marine bioresources
- Bioeconomy communication

Through both the research agenda and the action plan, the administration keeps a close connection to the latest developments of the Flemish bioeconomy, and adapts the policy actions accordingly.

CIRCULAR ECONOMY

Circular Flanders is the hub and the inspiration for the Flemish circular economy, jointly driven by the ministers of economy and environment. It is a partnership of governments, companies, civil society, and the knowledge community that act together on circular projects.

Circular Flanders was launched in 2017 to ensure Flanders transition to the circular economy by 2050. The current Flemish Government confirmed this objective and voiced their ambition to transform Flanders into a circular trendsetter in Europe by 2030. To do that, it aims to separate the material footprint created by Flemish consumption from economic growth and reduce that footprint by 30%.

The circular transition is far too big to assign to a single team or organisation. That is why the work is taken up by public-private partners who are working on six themed strategic agenda's, inspired by the European Green Deal, and 7 strategic levers. Each strategic agenda is a partnership in itself and is assigned a public and a private lead. They come up with targets together, define strategy, but first and foremost, they get things moving.

The themes of the strategic agenda's are circular construction, chemicals/plastics, water cycles, bio-economy, food chain and manufacturing.

To make the transitions come true, there is a whole series of habits, rules, and barriers native to the 'linear economy' that need to be tackled. For that reason, the strategic agendas are complemented by seven levers: financing, communication, research, jobs and skills, circular procurement, innovation and entrepreneurship and policy instruments.

Last but not least, there is the circular economy policy research center: CE Center. It conducts policy-relevant research in the context of the circular economy and brings together researchers from KU Leuven, UGent, UAntwerpen, UHasselt and VITO.

2.5
SMART SPECIALISATION IN FLANDERS

The Flanders' Smart Specialisation strategy aims to **focus government support** for innovation in a number of **priority areas**. The smart specialisation evolution in Flanders is driven from two angles.

- **At the policy level in Flanders**, it is recognized that clusters play an important role in a globalised world to support competitiveness. Active collaboration between companies and with other actors such as knowledge centres is essential to establish such clusters that have a pivotal role to,develop innovative ecosystems. Hereby, appropriate choices that build upon regional strengths make it possible to make a difference in global value chains at the international level for a small region.
- The European regional policy (ESIF) has stimulated the regions of Europe to adopt regional innovation strategies for smart specialisation to achieve more efficient use of the Interreg and ERDF funds. For the programme period 2014-2020 DG Regio introduced the concept of smart specialisation to the regions: as a prerequisite for the approval for operational programmes. In 2023, Flanders updated its RIS3 strategy for the program period 2021-2027.

The adoption of this smart specialisation strategy 2.0 is still based on the tradition in which steps were taken to define government priorities to acquire critical mass in government support. The Flanders R&I policy provides a mix of policy instruments combining these top down priorities with a broad variety of bottom up support programmes that are open for different technologies and sectors.

One of the strengths are the **strategic research centres** (see Chapter 3), that started in the eighties with the foundation of imec. This was continued in the following years with the most recent one, Flanders' Make, in 2014. Such institutes receive a grant from the government and participate in different programmes for support to research institutes on a competitive basis. They are all involved in tech transfer and have an active interaction with industry. Together with the spearhead clusters, the strategic research centres are the basis for the smart specialisation strategy.

In addition to the foundation of the strategic research centres, several initiatives were taken to foster the collaboration between industry and non-economic actors, with continued support to clustered activities in several forms. During the 2014-2019 governing period, two types of clusters were introduced: small-scaled, short-term initiatives called **"innovative business networks"** (IBN) and large-scaled, longer-term initiatives for **"spearhead clusters"**. (See Chapter 4)

The evolution in Flanders with the strategic research centres and the cluster policy has resulted in a landscape characterised by a combination **of bottom up programmes** complemented **with 9 focal points**[2] **(on which strategic research centres and spearhead clusters are active)**. For each of the focal points the government of Flanders has taken a decision to grant support to a strategic research centre or a spearhead clusters thereby marking the area as a priority for Flanders. **This choice equals a specialisation strategy with 9 priority domains** (see Chapter 6).

Besides the implementation of a smart specialisation at the regional level, Flanders has also contributed to the concept of smart specialisation by initiating the **Vanguard Initiative 'New Growth through Smart Specialisation'** in November 2013, that has grown to include 32 regions from 13 EU member states.

2 1. Sustainable chemistry / 2. Smart manufacturing / 3. Health and life sciences / 4. Specialised logistics / 5. Agro-Food / 6. Electronic systems, Iot and photonic systems / 7. Energy / 8. Environment & cleantech / 9. Blue economy

2.6
MONITORING AND REPORTING OF THE R&D&I POLICY

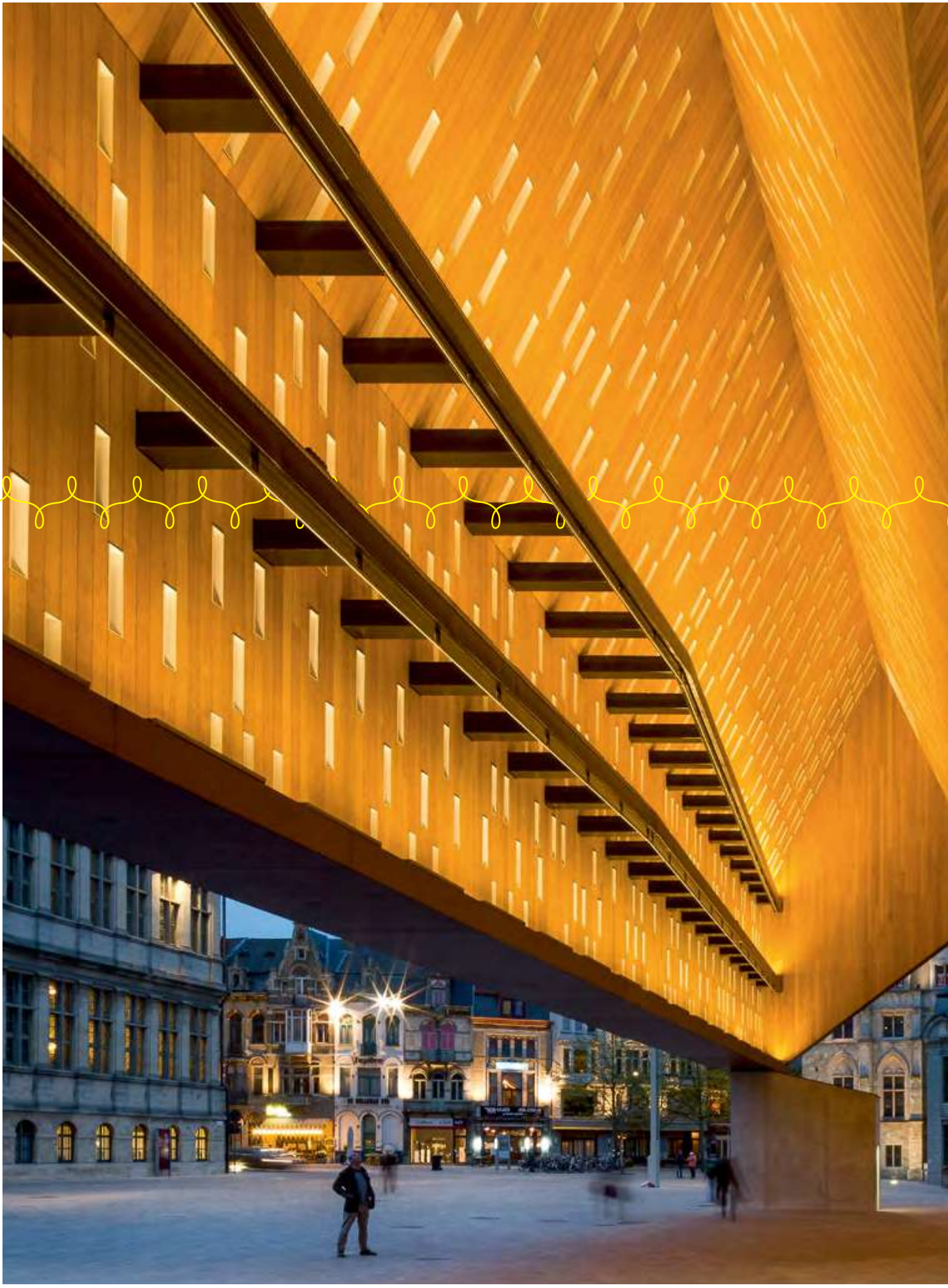
The policy initiatives, budgets and statistics that describe the Flanders' research and innovation landscape are being monitored and reported on in a structural manner at different policy levels. Most of these reports are the responsibility of the EWI Department. The various EWI agencies involved in STI also provide information and data about their own specific initiatives and budgets (e.g. through their annual reports) or conduct studies (e.g. on innovation support, by VLAIO), as does the advisory body VARIO (studies, advice, benchmarks).

The main sources of policy initiatives and statistical data and indicators in the STI field include:

- **"Speurgids Ondernemen & Innoveren"** (Budget browser Enterprise and Innovation): provides an overview of the budget allocations for economy, science, and innovation within the whole Flemish authority, and the R&D intensity (annually);
- **"Flemish Reform Programme"** (VHP) and **"National Reform Programme"** (NHP) of the **Europe 2020 strategy** in the framework of the **European Semester** (both programmes are submitted in April to the European Commission): the part that relates to R&D&I) (annually);
- The **"Flemish Indicator Book"**, which contains the policy indicators that shed a light on the Flemish potential in terms of science, technology and innovation. The Indicator Book is being published every two years since 1999, coordinated by the Interuniversity Centre for Research and Development Monitoring (ECOOM);
- The **"3% nota"**: the so-called '3% paper' is a publication from ECOOM in which the official data for Flanders on GERD, BERD, GBARD, the R&D-intensity, etc. are calculated (annually).

Furthermore, regular overviews of Flanders in the field of research and innovation are available through many **publications and reports from the EU and the OECD** in the field of R&D&I. These include the profile of Flanders described in the European Commission reports or in databases such as the report for Flanders of the RIM (Regional Innovation Monitor), the RIM policy initiative database, the Vanguard Initiative website, the S3-website of the Joint Research Centre (JRC), as well as in the many country reports on Belgium such as the reports on the European Research Area (ERA), the Research and Innovation Observatory (RIO), the OECD STI Outlook, the joint EC/OECD Policy Survey (and database) on Science, Technology and Innovation Policies (STIP), the R&D&I topics in the EC's Country Report on Belgium (European Semester), and the OECD Economic Survey Belgium report. Benchmarking the R&D&I performance is conducted by comparing the information and data that are available in the EC Regional Innovation Scoreboard (RIS), the Report on Economic, Social and Territorial Cohesion, the Belgian profiles in the EIS (European Innovation Scoreboard) and the 'Science, Research and Innovation performance of the EU' report etc.

In addition to the aforementioned publications, the Department of EWI also hosts the Flanders Research and Information Space (FRIS), containing a wealth of information on publicly funded research in Flanders. More information on FRIS is included in chapter 3, point 1.3.3.



CHAPTER 3

RESEARCH ORGANISATIONS

© Tom Dhaenens

1

HIGHER EDUCATION INSTITUTIONS[3]

1.1 UNIVERSITY ASSOCIATIONS

The backbone of the output generated by Flanders' academic and other knowledge actors is shaped by the 5 university associations. These associations each bring together one of the universities with one or more universities of applied sciences and arts. Universities of applied sciences and arts provide higher education and advanced vocational training, and their mission includes research and the provision of other services to society. The bachelor qualification is the highest obtainable at the universities of applied sciences and arts; master diplomas (and higher) remain the preserve of the universities.

The 5 university associations of the Flemish Community are:

- **Antwerp**: UA and 3 universities of applied sciences and arts in the city of Antwerp
- **Brussels**: VUB and Erasmushogeschool Brussel, and a cooperation agreement with the Royal Military School
- **Ghent**: UGent and 3 universities of applied sciences and arts, 2 in East-Flanders and 1 in West-Flanders
- **KU Leuven**: KU Leuven and 5 universities of applied sciences and arts diffused over various locations in Flanders
- **Limburg**: UHasselt and universities of applied sciences and arts PXL, along with TuL (= the Transnational University Limburg a cooperation between UHasselt and Universiteit Maastricht)

Universities and universities of applied sciences and arts each have their organisation that promotes dialogue and cooperation amongst them and defends their interests in a concerted way. Universities are united in **VLIR** (Flemish Inter-University Council), while the universities of applied sciences and arts come together in **VLHORA** (Council of Flemish Universities of Applied Sciences and Arts).

3 For more information, visit www.studyinflanders.be

ASSOCIATIE KU LEUVEN (AKUL)
Katholieke Universiteit Leuven and the 5 universities of applied sciences and arts Odisee, LUCA Schools of Arts, Thomas More, UC Leuven Limburg and Vives Hogeschool.
www.associatie.kuleuven.be

ASSOCIATIE UNIVERSITEIT GENT (AUGENT)
Universiteit Gent and the 5 universities of applied sciences and arts Arteveldehogeschool, HOGENT, Howest, KASK and Conservatoire.
www.augent.be

ASSOCIATIE UNIVERSITEIT & HOGESCHOLEN ANTWERPEN (AUHA)
Universiteit Antwerpen and the 5 universities of applied sciences and arts AP Hogeschool Antwerpen, Antwerp of Fine Arts, Conservatoire, Hogere Zeevaartschool and Karel de Grote Hogeschool.
www.auha.be

UNIVERSITAIRE ASSOCIATIE BRUSSEL (UAB)
Vrije Universiteit Brussel and the university of applied sciences and arts Erasmushogeschool Brussel, RITCS, KCB and a cooperation agreement with the Brussels based Royal Military School.
www.universitaireassociatiebrussel.be

ASSOCIATIE UNIVERSITEIT-HOGESCHOOL LIMBURG (AUHL)
Universiteit Hasselt and the university of applied sciences and arts PXL and MAD School of Arts.
www.auhl.be

1.2
UNIVERSITIES AND UNIVERSITIES OF APPLIED SCIENCES AND ARTS

The universities play a major role in (the output of) Flemish R&D. The universities generate almost 90% of all non-private scientific output in Flanders. The **five universities** of the Flemish Community are:

- Katholieke Universiteit Leuven (**KU Leuven**);
- Universiteit Gent (**UGent**);
- Universiteit Antwerpen (**UA**);
- Vrije Universiteit Brussel (**VUB**);
- Universiteit Hasselt (**UHasselt**);

And the **thirteen universities of applied sciences and arts** of the Flemish Community are:

- Artesis Plantijn Hogeschool (**AP Hogeschool**)
- Arteveldehogeschool
- Erasmushogeschool Brussel (**EhB**)
- Antwerp Maritime Academy – Hogere Zeevaartschool
- Hogeschool Gent (**HOGENT**)
- Hogeschool PXL (**PXL**)
- Hogeschool West-Vlaanderen (**Howest**)
- Odisee co-hogeschool (**Odisee**)
- Karel de Grote Hogeschool (**KdG**)
- UC Leuven-Limburg
- UC Leuven
- UC Limburg
- VIVES Hogeschool (**VIVES**)
- Katholieke Hogeschool VIVES Zuid (**VIVES Zuid**)
- Katholieke Hogeschool VIVES Noord (**VIVES Noord**)
- Thomas More
- Thomas More Kempen
- Thomas More Mechelen-Antwerpen
- LUCA School of Arts (**LUCA**)

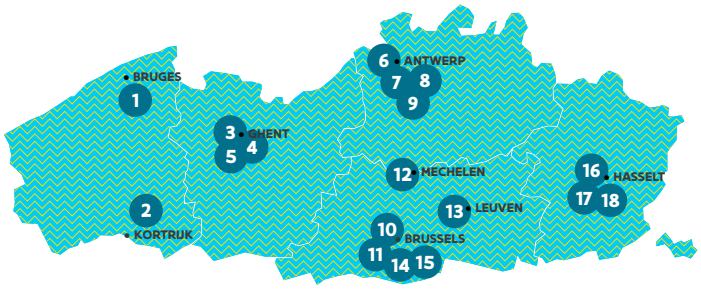
1.3
FUNDING

Public funding for the universities can be categorised into three budgetary flows:

- a **basic allowance** (from the Flemish Government's department Education and Training), amounting to 1,076.77 million euro in 2023, of which 285.9 million euro allocated for R&D-related initiatives;
- support granted on a **competitive** basis;
- a variety of (project-based) external (private) sources, donations, income from IPR, etc.

1.3.1
COMPETITIVE FUNDING

The **Research Foundation Flanders** (Fonds Wetenschappelijk Onderzoek Vlaanderen, FWO) and the **Special Research Fund** (Bijzonder Onderzoeksfonds, BOF) mainly support academic fundamental and basic research. Both have an array of different types of funding to do so. Two complementary programmes are aimed at attracting (Odysseus, FWO) and retaining (Methusalem, BOF) top researchers. FWO support is granted based on competition between the different universities, while BOF support is a performance-based research funding system of which the funds are allocated to the Flemish universities based on fixed competitive parameters.



1 vives University of Applied Sciences
2 howest university of applied sciences
3 GHENT UNIVERSITY
4 HO GENT
5 artevelde university of applied sciences
6 Antwerp Maritime Academy
7 University of Antwerp
8 KdG University of Applied Sciences and Arts
9 AP UN VERSITY OF APPLIED SCIENCES AND ARTS ANTWERP
10 erasmus HOGESCHOOL BRUSSEL
11 LUCA SCHOOL OF ARTS
12 THOMAS MORE UNIVERSITY OF APPLIED SCIENCES
13 KU LEUVEN
14 VUB VRIJE UNIVERSITEIT BRUSSEL
15 Odisee UNIVERSITY OF APPLIED SCIENCES
16 PXL UNIVERSITY OF APPLIED SCIENCES AND ARTS
17 UHASSELT
18 UCLL UNIVERSITY OF APPLIED SCIENCES

VLAIO and the **Industrial Research Fund** (Industrieel Onderzoeksfonds, IOF) mainly support industrial and applied research. VLAIO support is granted on a competitive basis, whereby applicants are evaluated on several criteria. VLAIO also provides support at academic level for research conducted at the request of companies; for example, through innovation mandates and Baekeland mandates. IOF support is a targeted subsidy for applied and strategic basic research, allocated to the universities based on fixed criteria and then granted based on intra-university competition.

Extra support is provided and aimed at further strengthening academic working conditions and research excellence, e.g. through the research infrastructure programme at FWO.

The **major budget sources** for 2023 were:

- FWO (427 million euro), of which 81.97 million euro for strategic basic research including doctoral grants, clinical research 20.09 milion euro and 33.34 million euro for research infrastructure;
- BOF (247.53 million euro);
- IOF and interface activities (62.86 million euro).

1.3.2 PRIVATE FUNDING

Higher education institutions also receive **support from private partners** (to conduct contract research), donations and bequests from private persons or institutes, the federal authorities, other Flemish public bodies (mainly the Department for Education and Training) and the EU (mainly through the Horizon 2020 programme, and to a limited extend from other EU programmes such as ERDF-Interreg). Funding sources from commercialising research results has also increased in recent years.

1.3.3 FLANDERS RESEARCH INFORMATION SPACE

FRIS

Researchportal.org

All information relating to publicly funded research at the Flemish research institutes can be consulted via the Flanders Research Information Space research portal (FRIS) www.researchportal.be. FRIS contains information on researchers, research institutes, publications, projects, patents, research infrastructures and datasets.

The FRIS Research Portal offers a unique view of publicly funded research in Flanders. The portal is a source of inspiration for reporting, analyses and statistics. In this way, the government can improve its policies and respond better to trends in society. Furthermore, the open data information in FRIS, which can be retrieved through open webservices, is used by several institutions to enrich their data.

In addition, FRIS strives to bring researchers closer together, to stimulate interdisciplinary research, to enable networking between researchers and to help find experts in certain disciplines. Thanks to direct integration with the systems of the scientific institutions, FRIS offers the most recent data. A change in the database of a research center is immediately implemented on the portal.

Information about researchers, research groups, publicly funded projects, publications, patents, research infrastructures and datasets, considered as open data, is accessible to everyone. And even on the European level whereas FRIS connects with the European platforms Open Aire and the European Open Science Cloud.

In the near future, FRIS will build services to integrate with funders. The goal is to facilitate the process for researchers when filling out their end reports for their grants for fundamental research by sending information that is already in FRIS to the funders reporting tool. At the same time, FRIS is investigating the possibilities to include AI-technology as a way to add extra services to research institutes, researchers and the broader public.

© Shutterstock

2

STRATEGIC RESEARCH CENTRES

Flanders aims to be a front-runner in the European knowledge society and economy by continuing to build on and utilize its existing knowledge base and by increasing its innovation potential. Apart from the universities, the leading Flemish research and innovation actors are the **four strategic research centres** (SRC, or 'Strategische Onderzoekscentra' (SOC) in Dutch), sometimes referred to as public research organisations (PRO). Each of the centres is active in a specific research area and they have co-founded several spin-off or start-up companies, often based on breakthrough research.

The Flemish Government concludes with each of these SRC a multi-annual management agreement including key performance indicators, in return for an annual grant. In addition, some SRC receive a grant for the execution of reference tasks on behalf of the Flemish government. The total budget from the Flemish Government for the 4 SRC reached 359.32 euro in 2023. The amount of public support for Imec alone is 150.26 million in 2023, which makes it the biggest funding from the Flemish Government awarded to any knowledge institute.

FLANDERS MAKE

Industry 5.0

- Strategic research centre that stimulates product and production innovation for the industry
- 850 researchers and 200 companies form an ecosystem in which they collaborate on research that leads to concrete solutions at companies.
- Close collaboration with universities and other research institutions
- **High-tech research infrastructure** for **testing** and **validating** new products, vehicles and machines
- **€ 86 million turnover in 2022**

www.flandersmake.be

VIB

Biotechnology

- Independent research institute doing cutting edge research on molecular mechanisms of life, from microorganisms to plants and human beings
- 1,900 scientists from 78 countries
- **Close collaboration** with Flemish universities and businesses **to bridge the gap** between **scientific research** and **entrepreneurship**
- Achieved major biotech breakthroughs
- **€ 139 million turnover in 2022**

www.vib.be

vito

Cleantech

- Independent research centre focused on accelerating the transition to a sustainable future by providing research-based insights and solutions
- Almost 1,200 employees from 50 countries, including over 120 people with a PhD
- Interdisciplinary research and large-scale pilot installations in the fields of energy, chemistry, materials, health technology and land use
- Supports **companies** create a net zero industry by 2050, **policy makers** build livable cities beyond 2050 and **society** adapt to existing climate change and limit further climate impact.
- In Flanders, Europe and the world
- **€ 237 million revenue in 2022**

www.vito.be

imec
embracing a better life

Nano and digital technologies

- World-leading **research and innovation hub** in **nanoelectronics and digital technologies**
- Over 5500 skilled people from over 95 nationalities
- Research sites across Belgium, in the Netherlands, and the USA, and offices in 3 continents.
- **€ 846 million revenue in 2022**

www.imec-int.com/en

2.1
IMEC

imec
embracing a better life

Nano and digital technologies
Imec is a world-leading research and innovation hub in nanoelectronics and digital technologies. Leveraging its unique combination of leadership in microchip technology with profound software and ICT expertise, imec creates disruptive innovation in application domains such as healthcare, smart cities and mobility, logistics and manufacturing, energy and education.

Imec employs over 5500 skilled people from over 95 nationalities. It is headquartered in Leuven (Belgium) and has distributed R&D groups at a number of Flemish universities, in the Netherlands, the USA and representation in 3 continents. In 2022, imec's revenue (P&L) totaled 640 million euro, of which 120 million euro from the Flemish Government.

The imec campus in Leuven (Belgium) consists of 24,400m^2 of office space, laboratories, training facilities, technical support rooms, and 2 cleanrooms which run a semi-industrial operation (24/7). There is a 300mm cleanroom that focuses on advanced R&D, a 200mm cleanroom for R&D, development-on-demand, prototyping and low volume manufacturing of innovative technology solutions for smart applications including sensors, actuators, and MEMS, advanced RF, life sciences technologies, silicon photonics, ...

Imec has unique laboratories for bioelectronics research, life sciences labs, state-of-the art tools for materials characterization and reliability testing, dedicated labs for sensor and imaging technologies, silicon photonics, ...

2.1.1
IMEC'S RESEARCH

Imec's research covers various aspects of nanoelectronics such as advanced semiconductor scaling, silicon photonics, low power sensing and actuating, radar and radio technology, and digital technologies including data science and AI. By setting up local and global ecosystems of partners across a multitude of industries, imec creates technology solutions enabling innovation in various domains, such as healthcare, smart cities and mobility, logistics and manufacturing, sustainable energy and smart education.

Among its fields of expertise:

- CMOS and beyond CMOS technologies
- Advanced patterning solutions
- Image sensors and vision systems
- Silicon photonics
- Photovoltaics
- GaN
- Sensor solutions for IoT
- Advanced (wireless) connectivity solutions
- Radar sensing systems
- Data science and AI
- Technologies for life sciences
- Artificial intelligence

Imec was founded in 1984 as a non-profit organization led by Prof. Roger Baron Van Overstraeten. It is supervised by a Board of Directors, which includes delegates from industry, Flemish universities and the Flemish Government. Since 1984, imec has been led by Roger Van Overstraeten, Gilbert Declerck (as of June 1999), and Luc Van den hove (as of July 2009).

2.1.2
IMEC'S VENTURING INITIATIVES

Imec offers an ecosystem of tailored venturing support to give new start-ups and entrepreneurs a head-start on their road to market. Imec has a long history of launching start-ups and supporting innovative ideas. Imec already launched more than 120 spin-offs since it's foundation in 1984.

Imec's business accelerator program, imec.istart, offers selected start-ups an initial financial injection (50,000 EUR pre-seed funding), professional coaching and mentoring, access to technology and working facilities, access to its network of partners and investors. Since its launch in 2011, imec.istart helped more than 198 tech start-ups in diverse fields, ranging from multimedia and logistics to the healthcare sector, to develop into sustainable ventures. In 2023, imec.istart was granted first place in the 'Top University Business Accelerators' ranking by UBI Global.

Imec.xpand is a venture capital fund initiated by imec, investing in innovative semiconductor and hardware research spinouts and startups. Imec.xpand is an independently managed, game-changing way to enable early-stage nano electronics-based innovation powered by imec, the world-leading R&D hub for nanoelectronics and digital technology.

2.1.3
LEVERAGING EXPERTISE TO EXCEL

Imec partners with other research leaders in the region to combine and leverage expertises and drive innovation and position our region as a leader in a specific research domain.

Holst Centre, set up in 2005 by imec and TNO (The Netherlands), is an independent research and innovation center, aiming at responding to the global societal challenges of tomorrow. Supported by local, regional and national governments, Holst Centre is located on High Tech Campus Eindhoven, benefiting from, and contributing to, the state-of-the-art on-site facilities. Holst Centre has over 193,5 employees from 28 nations.

EnergyVille was set up by imec, KU Leuven, VITO, and UHasselt to perform research into sustainable energy and intelligent energy systems. EnergyVille employs more than 400 researchers whose work centers around six interdisciplinary domains: photovoltaics, electrical and thermal storage, power control and conversion, electrical and thermal networks, buildings and districts, strategies and markets.

Solliance Solar Research was founded in 2010 as a joint venture between the Dutch TNO, the Belgian imec and ECN (the Energy research Centre of the Netherlands, that became a part of TNO since 2018. Together with the industrial and academic partners Solliance Solar Research plays a leading role in the worldwide research and development of thin-film solar technology.

OnePlanet research center is a Dutch innovation center for Food, Health and Agricultural Technology. It was launched in 2019 as a collaboration between imec Radboud University, Wageningen University & Research (WUR) and the academic hospital Radboudumc focusing on the development of sustainable technologies for food, health and agriculture.

2.2 VIB

Biotechnology

VIB (Vlaams Instituut voor Biotechnologie – Flemish Institute for Biotechnology) is an independent research institute where some 1,900 top scientists from Belgium and abroad conduct pioneering basic research. As such, they are pushing the boundaries of what we know about molecular mechanisms and how they rule living organisms such as human beings, animals, plants and microorganisms. Based on a close partnership with five Flemish universities – Ghent University, KU Leuven, University of Antwerp, Vrije Universiteit Brussel and Hasselt University – and supported by a solid funding program, VIB unites the expertise of all its collaborators and research groups in a single institute.

VIB's technology transfer activities translate research results into concrete benefits for society, such as new diagnostics and therapies and agricultural innovations. These applications are often developed by young start-ups from VIB or through collaborations with other companies. This also leads to additional employment and bridges the gap between scientific research and entrepreneurship.

VIB also engages actively in the public debate on biotechnology by developing and disseminating a wide range of science-based information.

The institute has already achieved major breakthroughs in the fields of cancer research, immunology and inflammation, neurobiology and neurogenetics, angiogenesis and cardiovascular disease, plant biology and plant systems biology. VIB manages three bio-incubators in Ghent and Leuven, as well as three bio-accelerators in Ghent. In 2022, its income amounted to 152 million euros, of which 53% was obtained through public funding.

2.2.1 VIB'S RESEARCH

VIB consists of 10 thematic research centers with a total of 93 research groups performing pioneering research at the campuses of the partner universities.

- VIB-KU Leuven Center for Brain & Disease Research
- VIB-KU Leuven Center for Cancer Biology
- VIB-KU Leuven Center for Microbiology
- VIB-UAntwerp Center for Molecular Neurology
- VIB Center for Inflammation Research
- VIB-UGent Center for Medical Biotechnology
- VIB-UGent Center for Plant Systems Biology
- VIB-VUB Center for Structural Biology
- Neuro-Electronics Research Flanders (NERF, empowered by imec, KU Leuven, and VIB)
- VIB.AI: Center for AI & Computational Biology

One of the institute's strengths is the combined expertise of its scientists, who are world leaders in their field, and the core facilities that allow the use of the latest technologies on a scale that cannot be achieved by a single research group.

Finding answers to the most crucial questions in tomorrow's life sciences requires both a multidisciplinary and multilevel approach, as well as different levels of magnification and aggregation. These levels range from organism to organ and cellular and subcellular levels to molecular and even atomic levels.

To enable such an approach, VIB scientists need critical mass, diversity and interdisciplinarity. Therefore, talented researchers and technicians are recruited from different academic and geographic backgrounds. Driven by curiosity, they are encouraged to think unconventionally and explore across boundaries.

Cooperation between Flemish research institutions is increasingly common. For example, NERF is an interdisciplinary research center, empowered by imec, KU Leuven and VIB. NERF studies neuronal circuits and develops new technologies to link circuit activity to brain function.

2.2.2 VIB'S TECH TRANSFER ACTIVITIES

While research forms the basis of scientific knowledge, transferring the research results to the marketplace is of equal importance to VIB. The Innovation & Business team ensures that research results are translated into tangible products and services that find their way to patients and consumers. Financial return from tech transfer activities is reinvested in VIB's basic research programs.

Translating scientific findings into drugs for patients or products for consumers is a long and costly process, requiring skills, expertise and financial means that exceed VIB's resources. To bridge this gap, VIB has established partnerships with several companies. Additionally, VIB's Discovery Sciences team specifically bridges the gap between promising targets to the commercial development of products, de-risking the initial investments of interested industry partners.

To fuel economic growth and accelerate the translation of VIB's research into actual products, investment in the establishment of new start-up companies is of the utmost importance. So far, VIB has been involved in creating over 30 new companies in fields such as therapeutics, diagnostics, agrotech, food, and animal health, employing around 1,000 people.

Biotech companies need appropriate infrastructure to carry out their work. VIB has invested in three bio-incubators in Ghent and Leuven, as well as three bio-accelerators in Ghent. These bio-incubators now house 43 companies with 680 employees. Ghent is also home to three bio-accelerators which allow small companies to accelerate their development into key players. Currently, 12 companies are located in these accelerators.

2.2.3 INVESTING IN CUTTING-EDGE TECHNOLOGY

Science and technology are inextricably intertwined. The development of new technologies often leads to breakthroughs in scientific research. VIB Technologies, which consists of Tech Watch and Core Facilities, ensures that its scientists have early access to a wide range of state-of-the-art technologies. Staying at the forefront in research also means staying on top of developments on the technology front. Tech Watch team continuously scouts for novel technologies of potential interest to VIB and, when appropriate, mediates early access to these disruptive technologies through partnerships with cutting-edge technology providers.

VIB believes in an integrated approach to the various 'omics' domains. This approach opens perspectives to gain more focused insights into the molecular blueprint of many development and disease processes. However, it requires a techno-scientific expertise that is impossible to create within one research group.

VIB has recognized this trend and made substantial investments in embedding high-tech platforms in the institutional core and service facilities. In consultation with Tech Watch team several leading-edge technology platforms have been implemented. VIB's core and service facilities do not only provide their high-tech equipment and expertise to researchers within the institute; they also reach out to scientists from academia and industry. A recent evaluation by an international expert panel has confirmed the status of VIB's core facilities as 'gold standard' in Europe.

In addition, VIB Technology Training offers comprehensive courses that equip researchers with hands-on experience using a variety of tools and methods, enabling them to overcome any challenge.

The recent introduction of VIB Spatial Catalyst has further enhanced VIB Technologies' offerings. This initiative has made spatial technologies more accessible by pooling expertise from across the institute and providing data analysis and software development support. This holistic approach ensures that researchers have all the resources they need to maximize the benefits of spatial technologies in their work.


© Shutterstock

2.3 VITO

Cleantech

VITO is an independent research organisation in the area of **cleantech and sustainable development** in Flanders. As an innovative customer-oriented research centre, it accelerates the transition to a sustainable world, providing research based insights and solutions, knowledge and technological innovations that facilitate this transition to a more sustainable society. VITO de- risks innovation for businesses and strengthens the economic and societal fabric of Flanders, with interdisciplinary research and large-scale pilot installations. VITO supports companies creating a net zero industry by 2050, policy makers build livable cities beyond 2050 and society adapt to exiting climate change and limit further climate impact.

VITO does this in the field of energy, chemistry, materials, health technology and land use. VITO unites different parties in a sustainable value chain. By cooperation, expansion and development of expertise, we can make smarter use of existing sustainable solutions and develop new technologies. Technology should be feasible and cost-effective. This calls for partnerships between research centres, commercial parties and the authorities, who together create impact in the sustainability transition. VITO is the driving force by providing practical knowledge, innovative processes and business models.

Anyone who wants to do sustainable business must opt for circular economy in all its forms. In 2022, VITO focused more than ever on circularity. The search for better and more sustainable forms of energy and energy management have led to new insights. In view of the challenges posed by climate change, VITO puts a lot of effort into everything to do with land use. More efficient use of agricultural land will lead to better harvests, less spraying and more profitable cultivation. By better monitoring the water in our watercourses, we can draw conclusions and make forecasts. In this way we can anticipate the negative consequences of a changing climate. VITO focuses on developing solutions that can capture and reuse CO2, reduce the energy demand for chemical processes and answer questions about the processing of plastic waste and residual flows. VITO also focuses on all environmental factors that determine our health. Through large-scale biomonitoring, VITO helps governments to draw conclusions and take measures.

In 2022, VITO employed almost 1,200 employees and 120 PhD's and postdocs of 50 nationalities. VITO had a revenue of 237 million euro.

2.4 FLANDERS MAKE

Industry 5.0

Flanders Make is the Flemish strategic research centre that aims at stimulating **product and production innovation** in the Flemish manufacturing industry, thus supporting the further digital transition towards Industry 5.0 and (consequently) further strengthening the international competitiveness of the Flemish manufacturing industry. Flanders Make's research focuses on the development of personalised, smart and connected products (vehicles and machines) and production systems (flexible assembly). Its 2022 revenue was 86 million euro of which 40.6 million euro of the Flemish Government.

Flanders Make identifies three market trends to which it responds with its research:
1. smart interconnected products and production systems
2. customised production at the cost price of serial production
3. sustainable production centred on human needs

2.4.1 KEY COMPETENCES

Flanders Make combines its expertise in 3 key competences, all related to modelling and virtualisation. For each key competence, a 10-year research roadmap has been developed and a cluster has been set up in which Flanders Make works together with universities and other research institutes as well as companies on (pre-competitive) research, tailor-made innovation (for individual companies) and testing and validation.

Under "*End-to-end design operation*" the focus is on model-based design methods and supporting software to help developers improve the increasingly-complex design process. Specific tools give designers near-instant insight into the different possible concepts and optimal design choices. We also offer support for production environments, in which we take the impact of production on the design into account.

Under "*Production*" we support businesses in their digital transformation to become 'factories for the future' by getting smart machines and people to work together. To achieve this, we perform research into flexible assembly units that can cope with multiple product variations.

'*Motion Products*' emphasizes products with a motion component such as vehicles and machines, helping enterprises to develop new 'future-proof' products which are smart, automatically adapt to the environment to provide optimal performance, and use digital, Industry 5.0 technology. The focus is on the architecture and the validation of systems, as well as the combination of autonomy and automation (autonomation) for professional applications.

2.4.2 RESEARCH INFRASTRUCTURE

Flanders Make provides high-tech research infrastructure where companies can test and validate their products, i.e. (components of) vehicles or machines, and optimise their production processes. All these activities take place in the three physical 'co-creation sites' (combining office space and research labs) of Flanders Make in Kortrijk (customised production Industry 4.0)), Lommel (vehicle development) and Leuven (machine development) and at the Drone innovation interest group EUKA in Sint-Truiden on the one hand, and in the labs and test facilities of the universities (inter alia the Core Labs dedicated to the clusters) and other research institutes associated with Flanders Make on the other hand. Today, Flanders Make has more than around 850 researchers and over 200 company members.

3

FLEMISH SCIENTIFIC INSTITUTES

Within the Flemish Community, there are five scientific institutes, each managed by a department of the Flemish Government. These perform scientific research in a specific policy field. Apart from building up and diffusing the knowledge gained from scientific research, the institutes also provide advice and assistance to policy-makers, as well as services to society as whole. Furthermore, they strive to develop and exchange their knowledge through international contacts or programmes and via cooperation with other (foreign) institutes, e.g. through membership of EU research networks.

Meise Botanic Garden

The **Agency Botanic Garden Meise** (Agentschap Plantentuin Meise) is a scientific research institute, that operates as a centre of excellence for research into tropical and European botany, with a collection of over 18,000 species of plants and one of the largest herbaria in the world. It has been a part of the Flemish Community, following its de-federalisation in 2014, as an agency of the EWI domain.

© Shutterstock

ILVO

The **Flanders Research Institute for Agriculture, Fisheries and Food** (Instituut voor Landbouw, Visserij- en Voedings onderzoek, ILVO) conducts research in four main areas: plant sciences (applied genetics, breeding, crop protection), animal sciences (functional nutrition), technology and food science (food safety) and social sciences; in many cases this research is conducted in collaboration with various international partners.

RESEARCH INSTITUTE NATURE AND FOREST

The **Research Institute for Nature and Forest** (Instituut voor Natuur- en Bosonderzoek, INBO) conducts research on themes such as fauna, flora, biotopes, areas and regions, sustainable land and water use, with a focus on factors such as ecohydrology, acidification, pollution and climate change.

KMSKA

The **Royal Museum of Fine Arts Antwerp** (Koninklijk Museum voor Schone Kunsten Antwerpen, KMSKA) is charged with the care of a unique art collection, composed of mainly Flemish works, complemented with several pieces from other schools.

Flanders Heritage Agency

The **Flanders Heritage Agency** (Agentschap voor Onroerend Erfgoed, AOE) conducts research into the immovable heritage of Flanders (archaeology, monuments, landscapes), focusing on themes such as the restoration of historic gardens, sea wrecks, historic organs, parks, industrial and maritime heritage, etc.

4

OTHER FLEMISH KNOWLEDGE INSTITUTES

Apart from the aforementioned organisations, there exist a variety of other institutions and organisations in the public domain with activities that primarily focus on (scientific) data collection, research and/or knowledge generation. In most cases, they are mainly or to some extent supported by the Flemish Government. Some of these organisations play a prominent worldwide role in their field of activity.

The largest knowledge institutes include:

The **Flanders Marine Institute**, VLIZ (Vlaams Instituut voor de Zee): is renowned for supporting coastal and marine scientific research. It does so by offering and array of services for which scientists do not have the time or resources, but that are nevertheless essential for the success of scientific research. It operates the Simon Stevin vessel (the Flemish multidisciplinary coast research ship), manages the InnovOcean campus site and the Flanders Marine Data and Information Centre, which is active in international networks such as the IOC of UNESCO,. It also houses the European Marine Board and supports the European-level initiatives EMODnet and JPI Oceans. VLIZ has been instrumental in supporting knowledge brokerage for the benefit of the Blue Economy in Flanders, where the new spearhead cluster 'Blue Cluster' is catalysing innovation projects among its industrial membership.

The **Institute for Tropical Medicine, ITM** (Instituut voor Tropische Geneeskunde, ITG): is one of the world's leading institutes for training, research and support of tropical medicine and health care in developing countries, providing (reference) clinical services for the management of tropical diseases. ITM hosts many international reference laboratories and is an expert centre on HIV.

The **Antwerp Zoo Centre for Research and Conservation (CRC)**: is the research department of the Royal Zoological Society of Antwerp (RZSA), conducting applied and fundamental hypothesis-driven conservation research in various zoological disciplines (e.g. veterinary sciences). Research takes place in Flanders, in zoos and associated institutions, as well as in Brazil, Cameroon and Congo (bonobo research).

Apart from the aforementioned institutions, the Flemish Government supports an array of different research centres, amongst which Orpheus Institute (artistic research into music) and the Alamire Foundation (interdisciplinary research into and valorization of music).

© Shutterstock

5 INSTITUTES GOVERNED BY OTHER AUTHORITIES

5.1 FEDERAL AUTHORITY

Belgium has **ten federal scientific establishments**, most of which are located in Brussels. They cover a wide variety of research activities and collections and include museums, libraries, weather and space observatories, as well as research institutes dealing with African culture, geology and public health. Some of these bodies not only perform research in specific fields of expertise, but also have a publicly orientated scientific mission. At the administrative level, they are managed by various policy fields and under the overall responsibility of the federal State Secretary for Science, as part of the Programmatory Public Service for Science Policy (BELSPO).

The federal scientific establishments have a **two-fold mission**: a scientific public service mission on the one hand (the development, maintenance and dissemination of scientific, technical and cultural information and documentation, collection conservation, etc.) and a research mission on the other hand (through research often conducted in partnership with the universities of the Flemish and/or French Community). As such, these establishments interact with and enhance the scientific potential and outcome generated by the actors in the Flemish STI landscape, particularly the researchers in higher education institutions who are active in the same field of activity. The federal scientific institutes are:

- the Belgian Institute for Space Aeronomy (BIRA);
- the National Library of Belgium (KBR);
- the Royal Belgian Institute of Natural Sciences (KBIN);
- the Royal Institute for Cultural Heritage (KIK);
- the Royal Meteorological Institute (KMI);
- the Royal Museum for Central Africa;
- the Royal Museums of Art and History (KMKG);
- the Royal Museums of Fine Arts of Belgium (KMSK);
- the Royal Observatory of Belgium (including the Planetarium) (KSB);
- the State Archives of Belgium.

In addition to these institutes, there also exist **federal partner institutions and other organisations subsidised by BELSPO** (for example, the University Foundation), whilst some of the federal scientific institutes report to other federal public services. E.g. in the field of health, Sciensano provides research and monitoring services on health-related risks in the broad sense (healthcare, animal health, environment, food safety, medications and vaccines…).

The Federal Government also has responsibility for two other research organisations, being **the National Institute for Radioelements (IRE)**, and the renowned **Belgian Nuclear Research Centre (SCK CEN)**.

Belgium has ten federal scientific establishments, most of which are located in Brussels. They cover a wide variety of research activities and collections and include museums, libraries, weather and space observatories, as well as research institutes dealing with African culture, geology and public health.

5.2 INTERNATIONAL INSTITUTIONS, ORGANISATIONS OR PLATFORMS IN THE STI FIELD

Apart from institutes related to or managed by the Government of Flanders and the Federal Government, there are also a few other EU or international institutions located in Flanders that collect scientific data or conduct research. Some of these receive funding or support from the Flemish Government.

Examples include:

- the **EU Joint Research Centre (JRC)** known as the **Institute for Reference Materials and Measurements (IRMM)**, location: Mol (nearby the Flemish VITO and the federal SCK/CEN);
- The executive offices of the **EU's Joint Technology Initiatives** for Innovative Medicines (IMI), Clean Sky, Electronic Components and Systems for European Leadership (ECSEL) Fuel Cells and Hydrogen (FCH), location: Brussels;
- **European Cooperation in Science and Technology (COST)**, funding organisation for science and technology research networks, location: Brussels;
- the **ESA Business and Innovation Centre (ESA BIC)**, location: Mol and Geel;
- **United Nations University Institute on Comparative Regional Integration Studies (UNU-CRIS)**, location: Bruges;
- the **European Marine Board (EMB)**, location: Ostend;
- **European Marine Observation and Data Network (EMODnet)**, location: Ostend;
- the **Project Office of the Intergovernmental Oceanographic Commission (IOC)** of UNESCO for the International Oceanographic Data and Information Exchange (IODE) programme, location: Ostend;
- **the Von Karman Institute for fluid dynamics,** which is funded by consortium of 15 countries, location: Sint-Genesius-Rode.

6 POLICY RESEARCH CENTRES

In 2001, the Flemish Government launched a centralised 'Steunpunten' programma (policy research centres programme) to provide a scientific basis for policy research. From 2016 on, a decentralised approach towards policy research centres was elaborated whereby every policy area was made responsible for setting up, funding and following up its own centres. The policy research centres that are active today with the EWI policy area are:

- **Expertisecentrum Onderzoek en Ontwikkelingsmonitoring van de Vlaamse Gemeenschap** (ECOOM, Expert Centre Research and Development monitoring of the Flemish Community): an inter-university consortium in which all Flemish universities participate;
- **Steunpunt Economie en Ondernemen** (STORE, Policy Research Centre Economy and Entrepreneurship): a cooperation between KU Leuven and UGent.

ECOOM (The Expertisecentrum Onderzoek en Ontwikkelings-monitoring van de Vlaamse Gemeenschap - Expert Centre Research and Development monitoring of the Flemish Community) is the policy research centre for the EWI-domain. ECOOM is, inter alia, responsible for the calculation of the official R&D-intensity indicator of Flanders and the mapping of Flanders within global value chains. ECOOM used to be focused on research and innovation policy, but extended its reach to entrepreneurship and economy with the integration of STORE (Steunpunt Economie en Ondernemen - Policy Research Centre Economy and Entrepreneurship) in 2022. ECOOM is a inter-university consortium in which all Flemish universities participate.

7

OTHER BODIES OF PUBLIC INTEREST IN THE FIELD OF SCIENCE AND INNOVATION

Several other long-standing public institutions of the Flemish Community, which are related to science policy in a more academic context, play a promotional or advisory role. Although they are not directly involved in policy-making, they are part of the broader Flemish STI domain:

- **Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten** (KVAB, Royal Flemish Academy of Belgium for Arts and Sciences), established in 1772;
- **Koninklijke Academie voor Geneeskunde van België** (KAGB, Royal Academy of Belgium for Medicine);
- **Koninklijke Academie voor Nederlands Taal- en Letterkunde** (KANTL, Royal Academy for Dutch Language and Literature), established in 1886;
- **Stichting Technologie Vlaanderen voor Innovatie en Arbeid** (STV voor Innovatie en Arbeid, the Flanders Foundation for Technology Assessment in Innovation and Work), which is a part of the SERV;
- **Vlaamse Academische Stem** (VLAST, Flemish Academic Centre for Science and the Arts) is a non-profit organisation supported by both the KVAB and the KANTL;
- **Waterbouwkundig Laboratorium** (FH, Flanders Hydraulics) is a centre of expertise for research and advice on hydraulic, nautical, sediment-related and hydrological topics.

8

RESEARCH INFRA-STRUCTURES

The Flemish policy relating to research infrastructure is the responsibility of two entities, namely FWO and the EWI Department. EWI is the liaison with the relevant minister. It drafts policy and is responsible for regulations. It represents Flanders in the Belgian consultative bodies and expresses the Flemish/Belgian position in international forums. FWO supports fundamental and strategic, basic research in Flanders. The three complementary financing instruments of the FWO for research infrastructure are: the programme for **medium-scale research infrastructure** (150,000 to 1,000,000 euro); the programme for **large-scale research infrastructure** (starting from 1,000,000 euro); and the programme for **international research infrastructure** (IRI).

An overview of the large-scale research infrastructure and the Flemish participation in International and European research infrastructures can be found online in our Research information Space (FRIS) (www.researchportal.org), or you can download our publication[4] 'Large scale research infrastructures in Flanders. Flemish participation in international research infrastructures (2020)'.

At present, Flanders participates in 28 European or International research infrastructures.

The European Infrastructure for Plant Phenotyping- EMPHASIS is planned to become an ERIC (European Research Infrastructure Consortium), by the end of 2024. Flanders will become host of the first European research infrastructure within Belgium. Flanders Institute for Biotechnology (VIB) will act as host institution.

4 Download publication via www.ewi-vlaanderen.be/publications.

9

COOPERATION AND OUTREACH TO BUSINESSES

9.1 COOPERATION AMONG KNOWLEDGE ACTORS WITHIN FLANDERS

The various Flemish R&D&I performers cooperate increasingly among each other. In some cases, this takes place through formal institutes or cooperation agreements. There is numerous cooperation through and with strategic research centres like VIB or imec, from the level of individual research groups up to the level of the university as a whole. Two examples of the latter are:

- **Energyville vzw**: association of KU Leuven, VITO, imec and UHasselt in the field of sustainable energy and intelligent energy systems. It provides expertise to industry and public authorities on energy-efficient buildings and intelligent networks for a sustainable urban environment. This includes, for example, smart grids and advanced district heating and cooling.
- **Neuro-electronics Research Flanders, NERF**: this basic research initiative is a collaborative venture between imec, VIB and KU Leuven. It aims to unravel the neuronal circuitry of the human brain through research that combines nano-electronics and neurobiology.

Cooperation may also take place on a project basis and include federal or international institutes that are located in Belgium. For example, ILVO cooperates with UGent and Scienscano. Imec and VITO have formed a consortium with private partners for the production of green hydrogen (Hyve). The InnovOcean site in Ostend is home to an array of actors in the field of marine issues: the province of West-Flanders, VLIZ (Flanders), IODE (UNESCO/IOC Project Office), the secretariats from the European Marine Board (EMB) and from the European Marine Observation and Data network (EMODnet). The EC's JRC IRMM in Mol cooperates in Belgium with, among other, VITO, imec, KU Leuven, VLIZ and UGent.

9.2 TECHNOLOGY TRANSFER

Networking with the knowledge institutions in the field of innovation takes place through the business developers of the **Technology Transfer Offices** of the five university associations, the similar services of the strategic research centres and the knowledge diffusion actors of the universities of applied sciences and arts.

The Tech Transfer Offices of the five Flemish universities are well developed and operate independently with a focus on the valorisation of the expertise within their own university association.

In order to lower the barrier for external potential partners they have developed a **common website** TTO Flanders, which offers a unique portal to the knowledge and technology of the five Flemish universities and thirteen universities of applied sciences and arts and aims to:

- be a unique point of contact for industry looking for research expertise and licensing opportunities
- maximise the valorisation of the available university knowledge and technology for the benefit of the economy and society
- further improve the collaboration between the TTOs of the Flemish universities
- strengthen the performance of the TTOs by developing common means and sharing best practices
- become a player on the European and international innovation scene.

To develop strategic alliances with companies, each Flemish university has created dedicated **expertise centres**. The expertise centres are clustered around five domain (and one residual category).

- Health;
- Materials & Chemistry;
- ICT & Electronics;
- Cleantech & Energy;
- Engineering;
- Others.

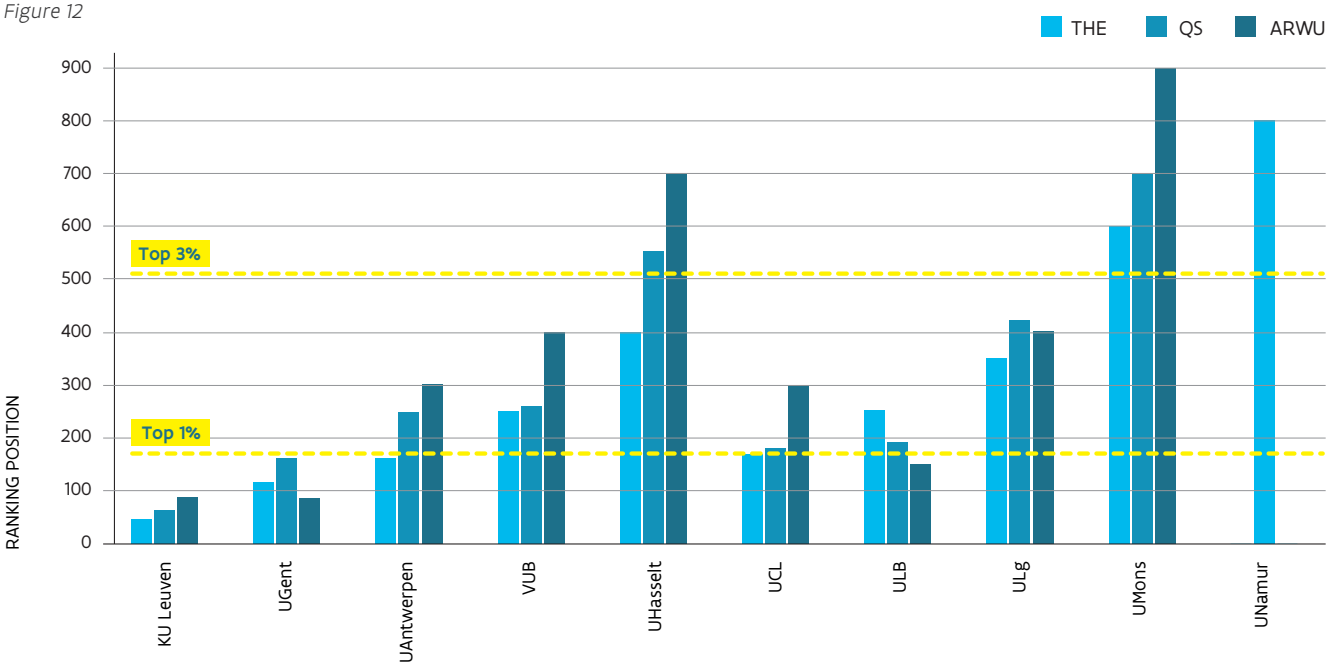
Each expertise centre is coordinated by a business developer who has a liaison role in the process of the valorisation of knowledge, between on the one hand the researchers and their findings and the other hand the business and the market. The business developers have an overview of the expertise within their domain and can refer efficiently within the university and the market.

10 PERFORMANCE FROM INSTITUTIONS BENCHMARKED INTERNATIONALLY

Several international rankings exist in which academic or knowledge institutes are listed, that can provide an indication of their relative strength in an international perspective. The presence of universities from the Flemish Community in the major worldwide rankings are as follows:

RANKING POSITION OF THE BELGIAN UNIVERSITIES 2023-2024

Figure 12



All the Flemish universities score very high on these three different rankings and belong almost for each ranking to the top 3% worldwide. The Catholic University of Leuven and the Ghent University even rank in the top 1% for all these three rankings.

Each ranking uses different criteria with different weights in their calculation of the ranking position. We give the main elements for these three well known rankings.

The Times Higher Education (THE) World University Rankings 2024 is an international "league table" ranking that uses 13 metrics clustered in following 5 indicators teaching, research, citations, industry incomes and international outlook.

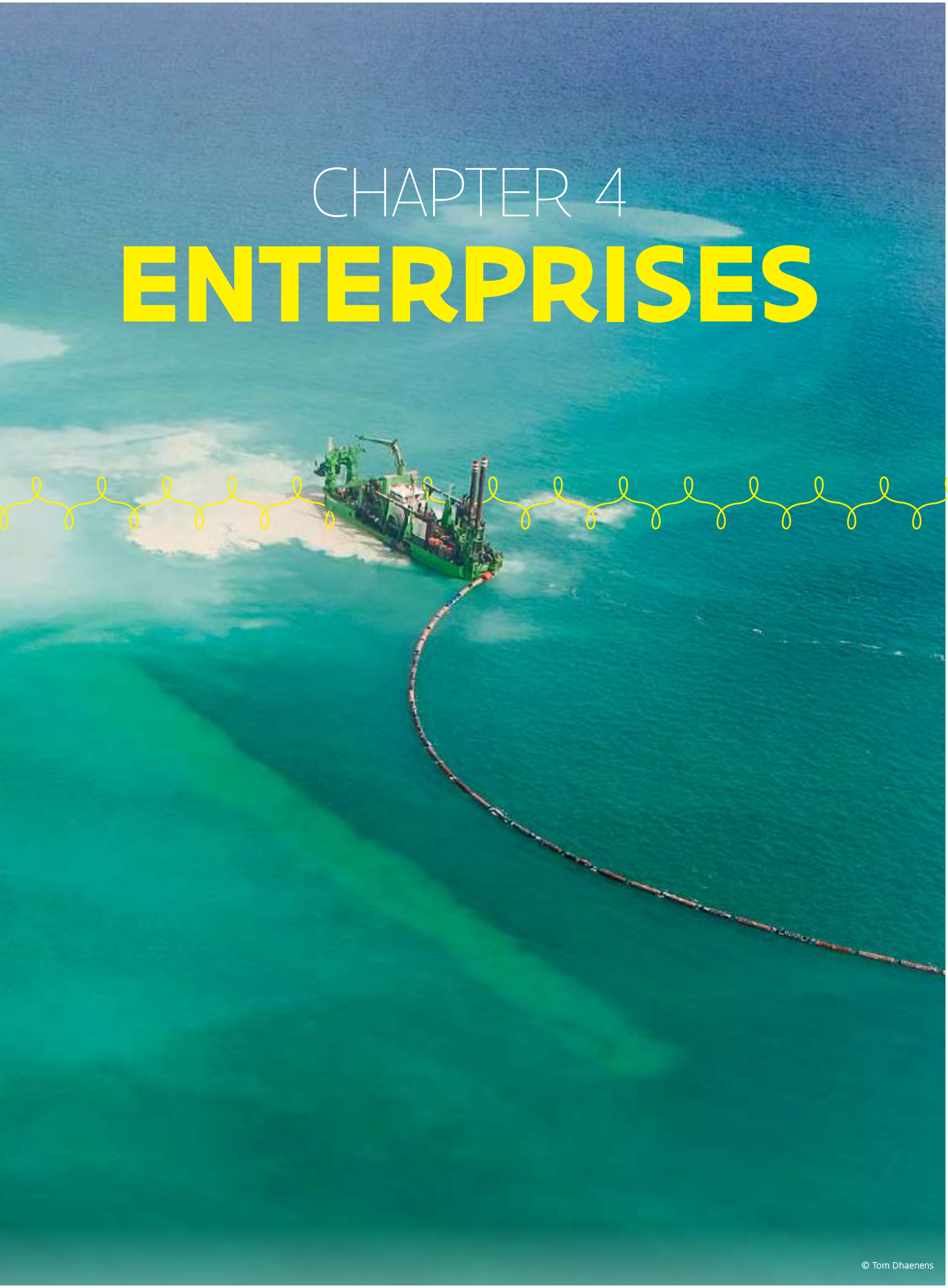
The Academic Ranking of World Universities (ARWU) 2023, the so-called "Shanghai Ranking", scores the 1,000 universities worldwide that have the best results on indicators that are mainly focusing on research (Highly cited researchers in Web of Science, articles in Nature and Science, articles in two citation indexes of Web of Science and results on the indicators per researchers) and prestige (Alumni and staf with awards). Since 2019 all Flemish universities are part of this ranking.

The Quacquarelli Symonds (QS) World University Ranking 2024 scores universities worldwide on the indicators Academic reputation, Employer reputation, Faculty/student ratio, Citations per faculty, International faculty ratio and International student ratio.

Next to this three well known rankings, the European Commission asked to develop another type of ranking. Since 2014 the **online ranking tool U-Multirank** is active. The U-Multirank is different than the other rankings because it scores the universities in groups from A "very good" to E "weak". This meets a frequently recurring criticism of rankings, namely that the allocation of ranking positions makes performance differences between universities appear larger than they really are. Through an online tool www.umultirank.org it is possible to compare universities based on the criteria of your own choice. The 35 different criteria are grouped into 5 dimensions: Teaching & learning, Research, Knowledge Transfer, International Orientation and Regional Engagement.


© Florin Cnejevici

CHAPTER 4
ENTERPRISES



© Tom Dhaenens

1

BUSINESS ENTERPRISE SECTOR

Enterprises are of major importance within the STI system in Flanders. **6% of R&D** in Flanders was funded by the business enterprise sector in 2021. However, they are a very heterogeneous group. Most large companies are clearly innovation-active. Some of them have significant research budgets. Given the industrial texture in Flanders, most of these large enterprises belong to multinational groups, so that their research policy is not exclusively determined in Flanders.

Alongside the large, innovation-intensive companies, a group of **high-technology SMEs** has arisen in recent years and continues to grow steadily. Moreover, even though the large majority of SMEs do not conduct research directly, many of them outsource research to some extent, so that they can also be regarded as innovation-oriented.

According to the Community Innovation Survey (CIS) carried out in 2021, 75% of all companies (2018-2020) in Flanders can be called innovative (= had either product innovations, business process innovations and/or ongoing or abandoned innovation activities). Nevertheless, innovation continues to be **largely concentrated** in industry and large companies.

International comparisons demonstrate that the **share of people employed in (medium) high-tech industry and high-tech services** in Flanders is lower than the EU average (9.3% versus 9.8% for the EU-27 in 2021). The R&D activities (expenditure) within companies in Flanders are mainly focused on the following high-tech sectors (2021): chemicals and pharmaceuticals (NACE 20-21) account for 39% of total BERD (based on a sample); motion picture, video and TV production, computer programmes, engineering, and technical testing and analysis activities (NACE 59-63, 71-72) account for 23%. Machinery and transport (NACE 28-30) account for about 8% and information technology, electronic products, optical products and electrical equipment (NACE 26-27) account for about 7%

2

INFRASTRUCTURE AND FINANCIAL INTERMEDIARIES

"INCUBATOR IN THE PICTURE"
OSTEND SCIENCE PARK

Ostend Science Park is a high-tech knowledge hub. A science park entirely dedicated to marine and maritime business and science. It is the first of its kind in Belgium and is the perfect breeding ground to boost blue business and support the Blue Economy.

Ostend Science Park is founded by Ghent University, Port Oostende and POM (West-Flanders Development Agency). Its ambition is to make researchers, entrepreneurs and their R&D smarter, by connecting them in an unique ecosystem. The interaction between knowledge-driven companies and specialists from knowledge institutions deepens their insights and helps them to find solutions together.

OSP is the operating base of many internationally renowned and highly regarded marine and maritime academics from Ghent University, united in https://www.marineatugent.be. It focuses on long-term relationships between them and specialized, high-quality and sustainable partners who want to learn from each other.

In Flanders, several science parks, research parks, incubators and accelerators offer facilities for research-based young companies and innovative enterprises. Often, these are spin-off companies from a university or a PRO and are located close to the knowledge centre in question. In some cases, an incubator is specifically oriented towards a particular scientific area.

Universities and strategic research centres are increasingly able to professionally guide spin-off companies, e.g. with finding the appropriate CEO, financial structure, and administrative issues. An important trend is the establishment and elaboration of different types of incubators. An overview of **business centres**


© Ostend Science Park

and incubators can be found at https://www.vlaio.be/en/guidance-advice/information-foreign-investors/finding-right-location.

The various private risk capital funds providers in Flanders include the large banks in Belgium, and specific funds such as **Capital@Rent, Capricorn, Down 2 Earth Capital, Falcon Fund, Hummingbird Ventures, etc. GIMV** (Flanders Investment Company) is Belgium's most important provider of private equity and venture capital and also a major European and international market player. It was initially set up by the Flemish Government, which still holds a minority stake in the company.

There also exist several funds that are linked to the Flemish universities or the strategic research centres. Examples of these are:

- the **Gemma Frisius seed capital fund** (KU Leuven)
- the multi-sector **Qbic Fund** (UGent, VUB, UA and VITO)
- **Imec.xpand**, aimed at start-up companies in the sector of ternet of Things (IoT)
- **Imec.iStart** offering coaching, support and infrastructure to (future) technology start-up companies (ranked in the top 5 of UBI Global rankings)
- **V-Bio Ventures Fund** (VIB) investing in European start-up companies and young companies in biopharmaceuticals, diagnostics, and agricultural improvements. It was initially set up by the Flemish Government, which still holds a minority stake in the company.

It is noteworthy to mention the following initiatives:

- **Business Angels Network Flanders (BAN Vlaanderen)**: a platform in which starting or growing entrepreneurs seeking risk capital are matched with informal private investors, the so-called "business angels". The latter offer not only money but also their own know-how, experience and contacts. BAN Vlaanderen is a marketplace where demand and supply meet, rather than an investment fund.
- **FINMIX**: a project from VLAIO aimed at companies with innovative challenges, growth ambitions or take-over plans, that use risk capital for their plans. It provides the possibility to these businesses to propose their plan to a panel of funding experts who will provide advice on the best funding mix.

An overview of risk capital providers in Flanders is available at the URL: https://www.vlaio.be/nl/begeleiding-advies/financiering/risicokapitaal/zoek.

3 COLLABORATION: INNOVATIVE NETWORKS AND RESEARCH-BUSINESS LINKS

Collaboration is an important aspect of Flemish innovation policy. It enables companies and knowledge centres to develop their internal know-how and allows them to tackle common technological issues efficiently, by using a shared platform for the demand and supply of R&D and other innovative matters.

3.1 CLUSTER POLICY

On 4 March 2016, the Flemish government approved the decree regulating support for innovation clusters in Flanders. The **objective** of the cluster policy is to unlock untapped economic potential and to increase the competitiveness of Flemish companies through active and sustainable cooperation between actors. The policy focuses on partnerships between Flemish companies. These companies are characterised by their growth ambitions, a high level of innovation awareness and their international outlook. In addition, they must be open to cooperation with other companies and knowledge centres, both for the realisation of their individual business objectives and for contributing to an increase in the competitiveness of a large group of Flemish companies.

Within the cluster, a cluster organisation acts as the facilitator of the network and the representative of the cluster members. Cluster organisations can be financially supported by the Flemish government for the implementation of their role as facilitators. With a support percentage of 50%, the companies should annually collect an equivalent amount of co-financing for the operation of the cluster organisation. In addition to the financial support, VLAIO offers operational support, so that the cluster organisations can optimise their operations and become better at what they already do.

The **spearhead clusters** fit in with important strategic areas for Flanders. These are large-scale initiatives that receive funding for ten years to expand their operations. Flanders has six spearhead clusters :

Blue cluster with an emphasis on sustainable economic activities related to the North Sea and beyond. The cluster is active in (1) coastal protection and mineral resources, (2) renewable energy and fresh water production, (3) maritime connectivity, (4) sustainable food production and marine biotechnology, (5) blue tourism and (6) ocean pollution.

www.blauwecluster.be

Flanders' Food in the domain of agro-food. The cluster has two knowledge-driven strategic objectives (lead in knowledge and lead to knowledge) and two business-driven strategic objectives (accelerate efficient & effective innovation and cross/create value chains). The knowledge-driven strategic goals will focus on (1) World Class Food Production, (2) Resilient & Sustainable Agrifood Systems and (3) Personalized Food Products & Healthy Diets.

www.flandersfood.com

Medvia focuses primarily on the crossover domains of biotech, medical and digital technologies where technological convergence generates new opportunities. To maximise its impact and reach, the focus of the cluster is not limited to the intersection where all three domains overlap, but also includes crossover opportunities where at least two of the three domains join forces.

www.medvia.be

Flanders Logistics cluster cluster (VIL) in the domain of specialised logistics. Its programming is centred around four main themes: (1) digitization with three sub-themes: smart technology, business models and data management, (2) sustainability themes like CO2 reduction and energy efficiency objectives for logistics in smart cities, circular and sharing economy, infrastructure (3) ambition 'Flanders gateways', i.e. Flanders as a global connected trading partner and (4) omni-channel distribution systems for various application.

www.vil.be

Catalisti in the domain of sustainable chemistry. The cluster has four main innovation programmes: "Renewable Chemicals", "Sidestream Valorisation", "Process Intensification and Optimisation" and "Advanced Sustainable Products".

www.catalisti.be

Flux50 in the domain of energy (Smart grid), five innovator zones have been selected: energy harbours, micro grids, multi-energy solutions for districts, energy cloud platforms, intelligent renovation.

www.flux50.com

3.2 LOCAL AND THEMATIC INITIATIVES

Examples of **place-based** initiatives, driven by one or more knowledge actor(s), and supported by various public stakeholders are Leuven Inc., Leuven Mindgate, or Ghent Bio-Energy Valley (GBEV) and BBEU (Bio-Base Europe). Thematic or sector-oriented organisations and networks exist in a broad variety. Examples include the FlandersBio network (life sciences – biopharmaceuticals, medical technologies or agricultural / industrial biotech products), Agoria Flanders (federation for the technology industry), MedTech Flanders (medical technology). The "Agoria International Business" helps technology companies increase their international market share and profitability by identifying business opportunities abroad.

HYDROGEN AS A THEMATIC PRIORITY

The Government of Flanders has put increasing emphasis on hydrogen as a future energy source, both driven by the presence of a significant hydrogen value chain in Flanders, as well as the presence of companies that will need hydrogen for their transition to a net zero industry. The hydrogen community in Flanders is organised in the "Waterstof Industrie Cluster (WIC)", a strong collaboration of companies, research institutes and government agencies and coordinated by WaterstofNet, the Flemish hydrogen knowledge and collaboration platform. They join forces on pilot projects, studies and project consortia along the hydrogen value chain to establish a complete hydrogen ecosystem in Flanders. In line with the Flemish policy vision on hydrogen the WIC published "An industrial Flemish Hydrogen Strategy 2025-2030" in December 2020.

Flemish universities and knowledge centres are conducting groundbreaking research in hydrogen technologies. An overview (updated yearly) of Flemish research groups and their activities can be found in the publication "Hydrogen Research in Flanders (January 2023)" on www.waterstofnet.eu/en/knowledge-centre/publications.

In July 2023 the Port of Antwerp-Bruges, North Sea Port and Port of Ostend have officially been recognised as a 'Hydrogen Valley' at the European level. That status is granted to a geographical area that houses a complete hydrogen value chain – from production to distribution, storage and local end-use in different sectors. The Flemish Hydrogen Ports Valley is coordinated by WaterstofNet.

For more information on hydrogen activities in the Flemish Region, please consult www.waterstofnet.eu/en

3.3 COLLECTIVE (RESEARCH) CENTRES

Collective research centres are recognised as a scientific organisation by BELSPO (and eligible for the scheme of reduced social contributions on researchers' salaries). Their main activities include collective research, various services of a scientific or technical nature (provided individually to their members), dissemination of technical information and training. The collective centres were founded after WWII by **the Belgian business federations**, usually by way of an association, and over the years several of other institutes have gained a similar status. The target groups of their applied research activities are either defined by sector or by theme. In addition, they often participate in European, federal and Flemish research programmes and carry out self-generated research to maintain their overall levels of knowledge and expertise.

These centres conduct (contract) research at the request of individual companies. These centres, including the equivalent organisations, are:Belgian Institute for Wood Technology and the Wood Training Centre (wood.be);

- Belgian Welding Institute (BWI);
- Belgian Research Centre for the Cement Industry (CRIC);
- Belgian Road Research Centre (BRRC);
- Scientific and Technical Service Centre for the Belgian Textile Industry (Centexbel);
- Belgian Building Research Institute (BBRI);
- Scientific and Technological Research Centre for Diamond (WTOCD);
- Collective Centre for the Belgian Technology Industry (SIRRIS), which includes several sub-sectors (e.g. "Aeronautics, Space, Security & Defence Industries");
- Coatings Research Institute (CORI);
- Research Centre for of certification and standardisation (CRIC-OCCN);
- Belgian Ceramic Research Centre (BCRC) (includes ceramics, glass and bricks industry);
- Metallurgic Research Centre (CRM) (for ferro and non-ferro metals);
- Tecnolec / Volta (electrical business).

3.4
RESEARCH – BUSINESS LINKS

The Flemish Government has developed a number of initiatives to **increase the valorisation** of research results, to better diffuse technology, and to strengthen the direct links between companies seeking to innovate and researchers from higher education institutions. **Support** is available to companies, institutions, networks and private individuals (researchers). In addition, promotional campaigns, such as "Ik innoveer!" - "I innovate!" with focus at **low innovation-intensive companies and SMEs** have been set up to better diffuse innovation among smaller and less-technological firms.

Other examples of current measures towards business include:

- **Baekeland mandates** and **innovation mandates** allowing researchers to conduct research with a specific business-oriented purpose in close relation with the business,
- support via the **TETRA Fund** aimed at applied-research projects,
- the support for the universities of applied sciences and arts to professionalise the knowledge diffusion towards SME's **"Blikopener"** ("Mind opener"),
- 'Collective Research & Development and Collective Knowledge Dissemination/Transfer (**COOCK**)' is a policy instrument that focuses on groups of companies, with the aim of valorising (basic) research results by accelerating the introduction of technology and/or knowledge,
- "Proeftuinen" (**Living Laboratories**, or test beds), were set up in various domains. These are structured test environments in which organisations can test innovative technologies, products, services and concepts, using a representative sample of individuals, who are used as testers in their normal living and working environments. Current Living Labs are active in the fields of Industry 4.0, Circular Economy and Smart cities.

The measures geared towards knowledge institutes are discussed under chapter 3.

4
BUSINESS EXPENDITURE ON R&D

Business Expenditures on R&D (BERD) represent 7.896 billion euro, of which the **chemical and pharmaceutical** sector led the way with 39% (2021). Other main performers were motion pictures, video and TV production, computer programmes, engineering, technical testing and analysis activities. The top-50 R&D-active companies jointly represent more than 52% of all R&D expenditures in Flanders. Of all total foreign investments in Flanders in 2022 (representing 5.26 billion euro), One in five took place in the R&D sector.

In **2021**, the R&D intensity in the business sector was 2.67%, an increase in comparison with 2020 (2.56%). Flanders therefore ranks higher than the EU-27 average, France, the Netherlands, Finland, Germany, Austria, Sweden and Japan , equal to the USA but lower than Korea.

For more information on BERD, see Annex III.


© Shutterstock

CHAPTER 5
CITIZENS

© kristof lauwers

1 SCIENCE COMMUNICATION

Since 1994 the popularisation of science, technology and innovation is considered an essential part of the STI policy in Flanders and is implemented in a Science Communication Policy Plan. The objectives are to strengthen the scientific and technological potential of all citizens, and in particular of youngsters. Too few young people opt for science and technology disciplines in education and in labour. Increasing the scientific literacy of society at large is also an important goal.

A number of **science information actors** contribute to the science communication policy: the Science Centre Technopolis (www.technopolis.be), the Science Communication Expertise Centres at the Universities and Colleges, RVO-society (www.rvo-society.be), and several others are involved. Their specific activities are posted on the Science Communication Agenda hosted bij Eos Wetenschap (www.eoswetenschap.be).

Media actors such as the Flemish Radio and Television Broadcasting (VRT), the science popularisation publisher EOS (www.eos.be), Journalismfund.eu are also involved.

The general public can meet with scientists, science educators and science communicators and interact with them in several ways at **science festivals**, Science shops, Science bars etc.

© Technopolis

2
CITIZEN SCIENCE

Since 2018 **calls for Citizen Science project proposals** are launched regularly in collaboration with Scivil, the knowledge centre for Citizen Science. Scientific projects rely on the active participation of citizens for data gathering and data processing.

Researchers from universities, universities of applied sciences and arts and research centres initiate the projects. They collaborate with trained science communicators to reach and to engage the general public.

In 2018 the FWO and the Royal Academy of sciences launched a comprehensive project **"Science Agenda: people's questions to scientists"**. They collected 10,559 questions which where categorized in 5 clusters: society, science and technology, biology, health and medicine and culture. From 2019 onwards these themes were further elaborated both in science policy (artificial intelligence, cybersecurity, personalised medicine) as in new science communication initiatives: science podcasts, video's "Science figured out", blogs etc.

New approaches will be explored whereby sandbox environments will be created by opening up data from knowledge institutes and companies, so that entrepreneurial citizens and small companies can develop and test new solutions.

In 2021, SciMingo, one of the science policy actors launched with support of the Flemish Government a science communication academy where young PhD students and scientists can acquire the necessary science communication skills.

3
STEM-INITIATIVES

Even though the figures are going in the right direction, attracting more people towards STEM-careers still remains a challenge for Flanders. In 2021, 28.67% of the total number of degrees awarded in higher education were degrees in mathematics, science or a technological discipline. In 2022 the STEM Monitor (an annual report the Flemish government uses to monitor the popularity of STEM courses of study) for school year 2020-2021 was published, reporting an increase in the number of pupils in STEM courses of study in the second and third grades of secondary education. In the entire secondary education system we notice that gradually more young people are entering courses of study centered around STEM (36.65% in school year 2019-2020 as compared to 33.50% in school year 2010-2011). Around 45 percent of all pupils leaving secondary education have a STEM diploma, which is almost 1.5% higher than in 2010-2011.

To stimulate youngsters to choose for STEM-careers, a **STEM Action Plan 2012-2020** was implemented. Under the current government, a STEM Agenda 2030 has been developed. The STEM Agenda 2030 is focusing on attracting more people towards STEM courses and careers, on STEM specialists and on the general strengthening of STEM competences in society at large: 'STEM literacy'. Concretely, the STEM Agenda 2030 is structured around 4 strategic objectives:

1. Society is aware of the importance of STEM competences.
2. Everyone with an interest and talent in STEM can find the way to a suitable STEM study program.
3. STEM education and training responds to the evolutions and transitions in business, research and society.
4. STEM competences are deployed as much as possible according to the needs, developments and transitions in business, research and society. The implementation of the Agenda will be realised on the basis of a biennial list of projects, linked to a biennial monitoring.

To coordinate STEM-initiatives and encourage knowledge sharing among companies and between companies and education, a STEM-HUB was set up at VLAIO.

4

SCIENCE CAREERS

Working as a researcher could be made more attractive by the development of **more transparent career paths and specific programmes to attract foreign talents or externally active Belgian (Flemish) researchers** that offer perspectives. Flanders' ambition to be a successful knowledge society can only be realized if it continues to invest in high-level research and good researchers.

Apart from the regular funding channels, such as the Special Research Fund (BOF) or the grants, fellowships and research projects from the Research Foundation Flanders (FWO), several **specific initiatives** were developed to encourage excellent researchers and support these in a long-term career path. These include budgets for the "tenure track mandates" that lead to a position within the ZAP (Senior Academic Staff) and Methusalem (long term support for excellent researchers), worth a total of about 31,7 million euro in 2023, as well as the Odysseus programme, a multi-annual brain gain initiative. Moreover, the Flemish government supports the training on career development and transferable skills of PhD students and other young researchers through funding of the Doctoral Schools at the Flemish universities within the framework of the OJO-support (support of young researchers), worth 5,5 million euro in 2021.

5

QUADRUPLE HELIX MODEL

In line with the ambitions to implement the quadruple helix model, the current government has asked VARIO for advice on a method for better implying citizens and civil society in the development and deployment of policy initiatives. VARIO has addressed this question in its advisory report 16 'Involving citizens in science and innovation policy' and the accompanying background report. It thus goes further than involving citizens in science and innovation, to which Flanders is already highly committed (see above).

In comparison, Flanders has been investing less in involving citizens in policy. VARIO has emphasized that good communication about government decisions and initiatives to the general public is pivotal for that. Furthermore the council has pointed out the importance of evidence-informed policy as a way to let the general interest of citizens take precedence and thus strengthen support and confidence in the policy. The 'data' for evidence-informed policy can be collected via studies, in a broad sense of the word or via co-creation, such as in living labs or in citizen science. VARIO advised to stimulate co-creation in the quadruple helix, and to take away existing hurdles.

VARIO is not in favor of a last form of involving citizens, as providers of direct input for science and innovation policy, This should happen only exceptionally, with expert citizens or citizens organised in Civil Society Organisations (CSOs). The latter is already done in Flanders as CSOs are traditionally represented in advisory councils, mainly on a local level, and more recently for example also in the sounding board group of the Moonshot and the Climate leap (Klimaatsprong) programmes. In this context VARIO asked to look beyond the 'usual suspects', and also at newer forms of civic organisations.


I
GOVERNMENT ACTORS
• Department EWI
• Research Foundation Flanders (FWO)
• Flanders Entrepreneurship and Innovation (VLAIO)
II
KNOWLEDGE INSTITUTIONS
• 5 University Associations (5 universities + 13 universities of applied sciences and arts)
• 4 strategic research centres: imec (nano & digital technology), VIB (life sciences), VITO (cleantech), Flanders Make (industry (5.0)
• > 15 scientific institutes
III
BUSINESS
6 spearhead clusters in domains:
• Sustainable Chemistry
• Agro-food
• Specialised logistics
• Energy & Smart grids
• Medtech
• Blue economy
IV
CIVIL SOCIETY
• Citizen & Open Science
• STEM
• Flemish Advisory Council for Innovation and Entrepreneurship (VARIO)
• Flanders Technology & Innovation (FTI)

CHAPTER 6

INTERNATIONAL ACTIVITIES

1 EU-LEVEL

Since 1993, the Belgian Communities and Regions have been able to execute their competencies at the EU and international policy level. The international aspects of STI cover a wide range of activities and institutions, embedded at the public, semi-public and private level. Consequently, no single administrative entity or agency has been set up to specifically manage these international aspects. This means that all the different public and private actors that are interested or eligible can initiate their own policy initiatives and programmes at the international level.

Since acquiring **external competence**, a substantial effort has been made to internationalize STI policy. More concretely, this policy is shaped by the preparation and follow-up of policy initiatives at the bilateral (towards a region or a country), inter-regional, inter-governmental, EU and international (OECD, UN) policy levels. The main policy focus is on the EU level.

© Shutterstock

Flanders needs to align its priorities in the field of R&D&I as much as possible with the priorities defined at the EU-level regarding the grand challenges, the European Research Area, the Europe 2020 strategy (European Semester) and Horizon 2020 / COSME programmes. Such goals can be achieved by striving towards excellence, increasing budgets, facilitating researcher mobility and participating in EU and international cooperation programmes and networks. This is particularly relevant for the future well-being of Flanders, given its open economy and the high proportion of international companies active in R&D. In addition to funding from the Flemish and the federal authorities, research actors also receive important amounts from various EU programmes (mainly Horizon 2020 and, to some extent, COSME and ERDF).

1.1 POLICY PREPARATION AND FOLLOW-UP

In the **Council of the European Union** meetings dealing with research and innovation policy, Belgium is represented by its Communities/Regions, whilst the federal authority acts as assessor. Consequently, Flanders is one of the authorities directly involved in the preparation of decisions within the Council, and takes its turn to represent Belgium according to a rotation system agreed with the other authorities. The meetings of the Council Working Group are attended by the **Flemish attaché for research and innovation**, who is assigned to (and is an integral part of) the Belgian Permanent Representation to the EU. Principal fields of action include the Framework Programme for Research and Technological Development, the European Research Area (ERA) and all related R&D&I matters in the broadest possible sense (for example, SFIC, ESFRI, etc.).

The domain of digital policy is becoming ever more important to innovation, as this field also governs the development, deployment and use of cuttting-edge technologies. These include artificial intelligence, data technology, virtual worlds, high-speed connectivity and more. To more closely follow and interact with EU digital policy, the department has seconded a part-time attaché at the Permanent Representation of Belgium to the EU to follow and report on policy developments in the Telecom Council at EU level.

Active involvement in the EU's research and innovation policies includes:

- preparation and follow-up of the ministerial decisions within the **EU Competitiveness Council** (Research);
- the EU's **Horizon 2020** and **COSME** programmes: preparation of the programme themes, act as National Contact Point (NCP), involvement as programme committee members in Horizon 2020, the ERA networks, OMC networks, and other support actions;
- preparation and participation in the meetings of the **ERAC**, the entity that advises the European Commission, the Council and the EU Member States on their research and innovation policy;
- participation in the bilateral meetings between the Commission and Belgium for the European Semester (Fact Finding Mission);
- participation in various **EU initiatives in the f ield of R&D&**I, such as the JTI (Joint Technology Initiatives), ESFRI (international large research infrastructure), the EIT (European Institute for Technology) and JPI (Joint Programming Initiatives) (see further in this chapter);
- contributions to or revision of the many **reports and consultations** involving the European Commission in the field of scientific research and innovation (e.g. the Flemish and Belgian National Reform Programmes for the European Semester, the various ERA reports, the report of the Research and Innovation Observatory (RIO), the EC/OECD STI Policies report…);
- active involvement in the discussions and preparations for the **programmes under the new EU Multi-Financial Framework 2021-2027**, such as the Digital Europe Programme, Connecting Europe Facility 2 and Horizon Europe.

1.2 EU FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION AND COSME

A major focus - and a major source of R&I budget – lies at the EU level; namely, the participation in the EU's **Framework Programmes** for Research and Innovation. Framework programmes (FPs) have been implemented **since 1984** and cover a period of several years. Since 2021, the nineth FP named Horizon Europe is active. The participation data (status August 2023) on the Horizon Europe programme show that actors in Flanders are participating strongly. With a financial return of 3.20%, Flanders is scoring above the expected level (see also Annex III). The percentages for FP8, FP7, and FP6 were 2.76%, 2.50%, and 2.12% respectively. Regarding Horizon Europe so far, 369 Flemish participants take part some 1,895 times in 1,372 projects, which generates approximately 920 million euro (from January 2021 until August 2023).

KU Leuven is the strongest Flemish and European University. KU Leuven and Ghent University are respectively on the first and the fifth place in the top-10 of all academic participants in the Horizon Europe. The Flemish top 5 is further completed by imec, the Free University Brussels, and VITO. The top-10 of Flemish participants account together for a budget of 681 million euro, which is about three quarters of the total Horizon Europe contribution to Flanders.

The overall results for the Framework Programmes show that the Flemish R&I ecosystems excels in fundamental and strategic research, with a strong participation in the European Research Council and in the Marie Skoldowska Curie instruments. In terms of applied science, the results show an apparent scientific specialization for the fields related to Health, Digital technologies, and Agriculture and bioeconomy.

In January 2020, evidence of the allocated budget for the participation in **COSME**, the EU's programme for small and medium-sized enterprises, shows that close to 40 million euro went towards various actors from Flanders, including the Enterprise Europe Network (EEN) Vlaanderen. This represents a little over 1.5% of the total budget for the period 2014-2020.

1.3 DIGITAL EUROPE PROGRAMME

The Digital Europe Programme is a new European framework programme launched in 2021. The programme offers a logical response to deepening Europe's single digital market and should be a complement the Horizon Europe Programme. The Digital Europe Programme is committed to strengthening digital capabilities of economy, industry and society. This puts the programme on the cutting edge in which also the Department of Economics, Science and Innovation (EWI), and more broadly taken the EWI policy domain, is active.

The Digital Europe Programme invests in 5 strategic areas:

1. High-Performance Computing (€ 2.227 billion);
2. Artificial Intelligence (€ 2,062 billion);
3. Cybersecurity (€ 1,650 billion);
4. Digital skills (€ 577 million);
5. Ensuring wide use of digital technologies and interoperability (€ 1.072 billion).

The Digital Europe Programme is applied in strategically important sectors and policy areas for Flanders such as manufacturing, mobility, agriculture and health and has strong links to the Flemish Artificial Intelligence and Cybersecurity Policy Agenda. The Flemish government is strongly committed to digital innovation. For instance, Flemish companies are supported through e.g. the spearhead clusters and the support mechanisms of VLAIO. In addition, there is a lot of digital expertise present in Flanders and there are clear interfaces with Flemish competences. The Digital Europe Programme is therefore potentially very important for Flanders. The actions from the Digital Europe Programme can contribute to the broadening of Flemish expertise, and conversely, the Flemish digital ecosystem can contribute to the completion of the actions from Digital Europe. In this context, Flanders has invested in three European Testing & Experimentation Facilities on Edge-AI, Smart Cities & Communities and Agrifood. The connection with Flemish expertise in digitizing companies is also demonstrated by the selection of three European Digital Innovation Hubs in Flanders: one focused on the general rollout of AI drawn by imec called Flanders AI EDIH, one focused on digitalizing the manufacturing industry drawn by Flanders Make called Digitalis and one drawn by EnergyVille with a focus on digitalizing energy in the built environment called EDIH-EBE.

1.4 EUROPEAN AND INTERNATIONAL PARTNERSHIPS & INITIATIVES ON R&I WITH FLEMISH PARTICIPATION

1.4.1 SITUATION UP TO 2021

Since 2007, various variable geometry initiatives have been set up at the EU level, whereby certain countries can participate in research and innovation as part of or complementary to the EU Framework Programme themes. These initiatives strive towards the accomplishment of a European Research Area. In several cases, actors from Flanders have joined in these projects and have occasionally received public support (from the EWI Department, VLAIO (previously IWT), FWO or Belspo).

The following figure provides a tentative overview of the initiatives in which Flanders or Flemish research actors participate. The figure is mainly about, but not limited to EU-initiatives.

JOINT TECHNOLOGY INITIATIVES (ARTICLE 187-INITIATIVES):

- Innovative Medicines Initiatives 2 (IMI2)
- Fuel Cells and Hydrogen 2 (FCH2)
- Electronic Components and Systems (ECSEL)
- BioBased Industries (BBI)
- Clean Sky 2
- EuroHPC (member of the LUMI consortium)
- Shift2Rail
- Single European Sky Air Traffic Management Research Joint Undertaking (SESAR)

JOINT PROGRAMMING (ARTICLE 185-INITIATIVES):

- Eurostars
- Active and Assisted Living (AAL)

JOINT PROGRAMMING INITIATIVES:

- Neurodegenerative Disease Research (JPND)
- Cultural Heritage and Global Change
- A Healthy Diet for a Healthy Life (HDHL)
- More Years, Better Lives (MYBL)
- Antimicrobial Resistance (AMR)
- Agriculture, Food security & Climate Change (FACCE)
- Connecting Climate Knowledge for Europe (JPI Climate)
- Urban Europe - Global Challenges
- Water Challenges for a Changing World (Water JPI)
- Healthy and Productive Seas and Oceans (JPI Oceans)

ERA-NETS:

- ANIHWA
- Aquatic Pollutants
- ASPERA-2
- Biodiversa
- BlueBio
- CHIST ERA II
- CHIST ERA IV
- C-IPM
- CONCERT-Japan
- CORNET
- EN SGplusRegSys
- ENSUF UE
- ENSUGI
- ENUAC
- ERAfrica
- ERACoSysMed
- ERA-CAPS
- ERA-CVD
- ERA HDHL
- ERA-IB
- ERA-MBT
- ERA-MIN II
- ERANID E-Rare 2
- E-Rare 3
- EURONANOMED II
- Eurotransbio
- FACCE Surplus
- FOSC
- HDHL INTIMIC
- HERA Cultural Encounters
- HERA UP
- Heritage Plus
- HIVERA
- ICRAD
- INFECT-ERA
- ICT-AGRI2
- ICT-AGRI-FOOD
- JPcofuND (2)
- LEAP-AGRI
- MARTERA
- M.ERA-NET (II)
- Neuron (II)
- NORFACE T2S
- Oceanera-net cofund
- PhotonicSensing
- Quantera
- RUS Plus ERA-Net
- Smart Grids Plus
- Solar-ERA-net
- Solar-ERA-Net Cofund 2
- SusAn FACCE
- Suscrop
- SUMFOREST
- Susfood 2
- TRANSCAN
- Waterworks

EUREKA!:

- ACQEAU
- CELTIC-Next
- Eureka
- EuroIPIDES
- Globalstars
- ITEA
- Metallurgy
- PENTA
- SMART

EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY (COST)

EUROPEAN INSTITUTE OF TECHNOLOGY (EIT) - KNOWLEDGE INNOVATION COMMUNITIES (KICS):

- Climate
- Digital
- Food
- Health
- InnoEnergy
- Manufacturing
- Raw Materials
- Urban Mobility

EUROPEAN INNOVATION PARTNERSHIPS:

- Active & Healthy Ageing (AHA)
- Agricultural Productivity and Sustainability
- Raw Materials
- Smart Cities and Communities (SCC)
- Water

FUTURE AND EMERGING TECHNOLOGIES (FET) FLAGSHIPS:

- Graphene
- Human Brain Project

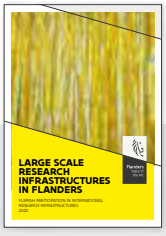
SET-PLAN

EUROPEAN STRATEGY FORUM ON RESEARCH INFRASTRUCTURE (ESFRI):

- Digital Research Infrastructures for the Arts and Humanities (DARIAH)
- European Social Survey (ESS)
- Survey of Health, Ageing and Retirement in Europe (SHARE)
- Distributed System of Scientific Collections (DISSCO)
- Integrated Carbon Observation System (ICOS)
- e-infrastructure for Biodiversity and Ecosystem Research (LifeWatch)
- Infrastructures for Analysis and Experimentation on Ecosystems (ANAEE)
- A Distributed Infrastructure for Life-science Information (ELIXIR)
- European Marine Biological Resource Centre (EMBRC)
- European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences (Euro-BioImaging)
- Integrated Structural Biology Infrastructure (INSTRUCT)
- The European Organisation for Nuclear Research - Compact Muon Solenoid (CERN-CMS)
- Dutch-Belgian Beamline ESRF (Dubble)
- IceCube Neutrino Observatory (IceCube)
- The European Organisation for Nuclear Research-Isolde Radioactive Ion Beam facility (CERN-Isolde)
- Mid-Infrared ELT Imager and Spectrograph (METIS)
- Système de Production d'Ion Radioactifs en Ligne de 2e génération (SPIRAL2)
- Partnership for Advanced Computing in Europe (Prace)

OTHER INITIATIVES:

- European Southern Observatory (ESO)
- European Space Agency (ESA),
- European Molecular Biotechnology Organisation/Laboratory (EMBO/EMBL)
- Mercator Telescope
- Einstein Telescope
- ...



https://www.ewi-vlaanderen.be/publicaties

1.4.2 SITUATION FROM 2021 ONWARDS

Within the Horizon Europe Programme, only three types of partnerships continue to be organised:

1. Co-programmed European Partnerships are partnerships between the European Commission and private and/or public partners based on a Memorandum of Understanding and/or contractual arrangements. Each Member State or region is responsible for implementing the R&I activities. Co-funded European Partnerships are European public-public co-funded partnerships between the European Commission and the EU countries. National or regional research and Innovation funding agencies and other public authorities form the core of the consortium. The topics of the call for proposals related to a particular partnership are included in the Horizon Europe's Work Programmes.

2. Institutionalised European partnerships are partnerships whereby the EU member states initiate – or jointly set up – R&D&I funding programmes and the European Union may decide to participate. Three different legal bases can be distinguished, namely Article 185 of the Treaty on the Functioning of the European Union (TFEU), Article 187 of the TFEU which covers public-private partnerships such as Joint Undertakings, and finally the EIT Knowledge and Innovation Communities (KICs) which cover the knowledge triangle.

Currently the last wave of Horizon Europe partnerships is being discussed. From 2024 onwards, they will be included in the Horizon Europe work programme at the appropriate places.

In total, the European Commission – through a process of co-creation – has identified 50 potential European partnerships[5] in 2019. These identified partnerships will be subject to a selection procedure through the Strategic Coordination Process, in which the Member States and the European Commission participate on an equal footing. The selected partnerships (i.e., titles or themes) will be formalised via the Strategic Plan that will be drafted for the first wave (set-up from 2021-22 onwards).

5 Initially the Commission had identified 49 European partnerships, but due to the COVID 19 pandemic, an additional partnership "Pandemic Preparedness and Societal Resilience" has been announced.

A second wave of partnerships will be selected and formalised in an updated Strategic Plan (2023-24). The following fourteen European partnerships will be selected for the first wave, with Flanders participating in thirteen of the fourteen partnerships. There is no Flemish contribution to the European Partnership on Metrology, only the Federal Public Service Economy participates.

- Co-programmed European Partnerships:
  - European Open Science Cloud (EOSC) Partnership
- Co-funded European Partnerships:
  - European Partnership for Chemicals Risk Assessment[6]
  - European Partnership – ERA for Health[7]
  - European Partnership on Transforming Health and Care Systems[8]
  - European Partnership – Driving urban transitions to a sustainable future[9]
  - European Partnership for Clean Energy Transition[10]
  - European Partnership Rescuing Biodiversity to Safeguard Live on Earth[11]
  - European Partnership for Blue Oceans[12]
  - European Partnership Water Security for the Planet[13]
  - European Partnership for Innovative SMEs[14]
- Institutionalised European Partnerships based on Article 185
  - European Partnership on Metrology[15]
- Institutionalised European Partnerships based on Article 187
  - EU-Africa Global Health Partnership[16]
  - European Partnership for High Performance Computing[17]
  - Chips Joint Undertaking[18]

6 Predecessors under H2020 were Human Bio-monitoring (HBM4EU) and a number of other actions.
7 Ca. 10 previous and current ERA-NET actions
8 Predecessors under H2020 were AAL2 (Art. 185), JPI 'More Years, Better Lives' and others
9 Predecessor under H2020 was JPI Urban Europe.
10 Predecessors under H2020 were around 10 existing ERA-NET Cofund actions.
11 Predecessors under H2020 were ERA-NET Biodiversity, EKLIPSE and ESMERALDA
12 Predecessors under H2020 BONUS, MARTERA, JPI Oceans, BlueBio.
13 Predecessor under H2020 was Water JPI.
14 Predecessor under H2020 was Eurostars-2
15 Predecessor under H2020 was EMPIR (Art. 185).
16 Predecessor under H2020 was EDCTP2 (Art. 185).
17 Predecessor under H2020 was EuroHPC (Art. 187)
18 European Partnerships for Key Digital Technologies


© Marco_Piunti

1.5 SMART SPECIALISATION SPEARHEAD DOMAINS IN THE EU CONTEXT

In 2012, following the Communication 'Regional Policy contributing to smart growth in Europe 2020', the EC set up thematic **S3 Platforms (industrial modernisation, Energy and Agrifood)** to assist EU countries and regions to develop, implement and review their Research and Innovation Strategies for Smart Specialisation (RIS3). The EC's Joint Research Centre S3 platform maps the S3 profiles forwarded by various authorities in Europe. The **Flanders' profile** consists of priorities that are part of a smaller number of the Flanders smart specialisation domains, of the updated RIS3 2.0 for the program period 2021-2027: (1) Sustainable chemistry, (2) Smart manufacturing, (3) Health and life sciences, (4) Specialised logistics, (5) Agro-Food, (6) Electronic systems, Iot and photonic systems, (7) Energy, (8) Environment & cleantech, (9) Blue economy.

Catalisti
sustainable chemistry and synthetics
www.catalisti.be

Flanders' Food
agro-food
www.flandersfood.com

Flanders Logistics Cluster (VIL)
specialised logistics
www.vil.be

Flux50
energy and smart grids
www.flux50.com

Blue cluster
sustainable North Sea economic activities
www.blauwecluster.be

Medvia
crossover biotech, medical and digital technologies
www.medvia.be

1.6 EU REGIONAL POLICY

VLAIO is responsible for the implementation of the Flemish programmes related to the **European Regional Development Fund** (ERDF) delivered under shared management with the EU Commission. ERDF is one of the five European Structural and Investment Funds. With these Funds post 2020, EU aims to become more competitive and smarter, through innovation and support to SMEs to become greener, more connected, to become more social, and closer to citizens, The goal of EU regional ERDF policy is to strengthen the economic and social cohesion by pursuing a better balance between the different EU regions. To achieve this, the Fund has two strands: (1) invest in growth and employment (with a focus on the less developed regions in the Union) and (2) European Territorial Cooperation through Interreg (to foster cross-border, transregional and interregional cooperation).

The programme 'ERDF Flanders' is investing in two thematic objectives Smart Flanders and Sustainable Flanders, with specific territorial investment strategies for Limburg, West-Flanders, Kempen and the larger cities Antwerp and Ghent. ERDF programme has also a funding instrument 'interregional innovative investments' (I3) to develop EU value chains and commerciase joint innovation projects.

The programme has an EU-budget of approximately 276 million euro for the whole period. Together with the national contribution, the total financing amounts to approximately 596 million euro.

ERDF Interreg is a collection of multiple programmes that, in synergy with other EU funds or programmes (e.g. Horizon), operate within the same EU post 2020framework aimed at smart, green and inclusive growth and jobs for a stronger EU. Flanders uses these crossborder programmes to complement and strengthen the EDF Flanders programme.

Distinction can be made between three types of Interreg programmes that Flanders manages and executes in cooperation with other regions:

- **Cross-border programmes** are aimed at cooperation between bordering regions of different countries. Flanders takes part in the programmes Border regio Flanders-Netherlands, Euregio Meuse-Rhine, France-Wallonie-Flanders.
- **Transnational programmes** cover a larger area and are aimed at wider cooperation between multiple regions. Flanders takes part in the programmes North Sea Region and North-West Europe.
- **Interregional programmes** cover thematic cooperation between regions and are not bound geographically, contrary to the two aforementioned types. Flanders takes part in the programmes Interreg, URBACT en INTERACT.

1.7 VANGUARD INITIATIVE

An important initiative in the development of a more focused demand-driven approach is the so-called "Vanguard Initiative", an **inter-regional network** of currently 38 regions from 14 EU Member States. Among these regions are for example Baden-Württemberg, the Basque Country, Lombardy, North-Rhine Westphalia, Saxony, Rhône-Alpes, Wallonia, Catalonia, and Scotland. The Initiative's main ambition is to contribute to the European agenda and boost industrial transformation by innovation in the EU as well as set up networks among regions of different (non-bordering) countries in several domains. The cooperation of the regions also aims at generating an evidence base to support the EU Commission in the development of Smart Specialisation Platforms in key growth areas.

As such, the Vanguard Initiative supports the development of **innovative industrial value chains** in Europe by building on smart specialisation (S3) strategies. More specifically, it aims to provide industrial stakeholders with easier access to (connected) demonstration facilities. These activities are based on a four-step Vanguard Initiative methodology: learn, connect, demonstrate, commercialize. This methodology is being applied in 8 industry-led pilot actions, each based on one priority area (KET) in Europe.

Flanders takes the co-lead, together with Norte (Pt) and South-Netherlands, in the pilot action called "High Performance Production through 3D Printing". This focuses on creating a (virtual) platform for 3D printing infrastructure, capacities and competences aimed at developing a European demonstration and piloting network. Also in the Smart Health/Personalised Medicine Pilot Flanders takes the co-lead, together with Sout-Netherlands and East-Netherlands. Moreover, Flanders is also involved in the following **pilot actions:**

- Bio-Economy – Interregional cooperation on innovative use of non-food Biomass;
- ADMA Energy - Advanced Manufacturing for Energy-Related Applications;
- NANO - New nano-enabled Products;
- ESM - Efficient and Sustainable Manufacturing
- AI – Artificial Intelligence

The Vanguard Initiative seeks to **lead by example** in developing interregional cooperation and multi-level governance for supporting clusters and regional eco-systems to focus on smart specialisations in priority areas for transforming and emerging industries. Vanguard regions want to build synergies and complementarities in smart specialisation strategies to boost world-class clusters and cluster networks, through pilots and large-scale demonstrators. These investments will strengthen Europe's competitive capacity to lead in new industries in the future and develop lead markets that offer solutions to societal challenges.

1.8 VLEVA

The Flemish-European Liaison Agency (VLEVA) is a not-for-profit association which is subsidized on a structural basis by the Flemish Government. VLEVA's mission is to **form a link between the EU and the civil society and local authorities** in Flanders. In the field of STI VLEVA monitors the calls from various EU initiatives, in order to provide maximal information on opportunities for EU programme participation for actors from Flanders. It also takes part in the European Regions Research and Innovation Network (ERRIN) for Flanders.

All the different public and private actors that are interested or eligible can initiate their own policy initiatives and programmes at the international level.

2 BILATERAL AND INTERNATIONAL

2.1 BILATERAL AND INTERNATIONAL CO-OPERATION AND AGREEMENTS

2.1.1 DEPARTMENT OF FOREIGN AFFAIRS

Flanders acts internationally in all areas for which it has internal jurisdiction such as economy, innovation, education and employment. Flanders has the constitutional right to conclude internationally-binding treaties in these areas, and can appoint diplomatic representatives abroad. **The Department of Foreign Affairs** monitors international policy coherence and is responsible for the coordination between the various policy areas. It is also the first point of contact for foreign embassies and diplomatic representations.

The Department of Foreign Affairs is the responsible administration for **bilateral and multilateral treaties, agreements and declarations of intent**. These agreements are often elaborated through multi-annual working programmes that cover various policy areas, one of which is scientific research and innovation. Consequently, the treaties foresee collaboration between EWI actors and one or more of their foreign counterparts. These agreements are managed by the Department of Foreign Affairs. The current active agreements include those with Estonia, Latvia, Poland, South Africa, Rumania, Lithuania, Croatia, Slovenia, Hungary, Bulgaria, North Rhine-Westphalia (Germany), Catalonia (Spain) and the German-speaking Community (Belgium). Several other agreements are currently being negotiated and various meetings are taking place with other regions and countries. Previously, general agreements were concluded in the field of R&D&I between Flanders and various non-European partners; for example, with Israel for cooperation in R&D in industry (2000) or with Alberta (Canada) for scientific and technological cooperation (1990).

The Minister-President of Flanders offers Flemish STI actors (universities, universities of applied sciences and arts, research organisations, other knowledge institutes, etc.) the possibility to participate in official missions abroad, based on the so-called "**academic diplomacy**" principle. During these missions, the opportunity sometimes arises to conclude general or specific cooperation agreements with actors from the region or country being visited. Flemish STI actors (universities, innovative companies, knowledge institutes) can also participate in Belgian economic missions or other official missions (e.g. State visits) that take place all over the world. These missions can be led by the King of the Belgians, the Belgian Foreign Affairs Minister, or a Belgian prince or princess. Conversely, official visits of foreign head of state, prime ministers, ministers or other officials to Belgium may also lead to cooperation with Belgian (including Flemish) actors in the field of research, or signing of agreements at the public level or bilaterally among STI actors.

2.1.2 FLANDERS INVESTMENT AND TRADE (FIT)

Another important actor in the International Flanders policy area is the **Flanders Investment and Trade (FIT)** agency. FIT supports the international activities of Flemish companies and attracts foreign investors to Flanders. It assists, supports and stimulates companies in international business. FIT offers tailored advice and guidance. Companies can call on its networks of contacts both at home and abroad. And it provides financial support and information on a wide range of financial incentives. Together with VLAIO, it forms the Enterprise Europe Network Flanders.

FIT has a worldwide network of **over 90 offices**. It includes several **technological attachés** that focus on future-oriented, innovative and technological fields of development, specifically in growth markets outside Europe. Each attaché is active in several technological sectors that are most relevant and offer opportunities for the region concerned. Their work is coordinated by the Science & Technology Coordinator Filip De Weerdt.

FLANDERS INVESTMENT & TRADE AGENCY: PRESENCE IN THE WORLD

Figure 13

Source: © Flanders Investment and Trade (FIT) Agency

TECHNOLOGICAL ATTACHÉS AT THE FLANDERS INVESTMENT AND TRADE AGENCY

Table 3

HOTSPOT	FOCUS AREA	FOCUS DOMAIN
NEW YORK	East Coast US	Health Tech
PALO ALTO	Bay Area – West Coast US	Digital Tech & Climate Tech
PARIS	France & South Europe	Digital Tech & Health Tech
LONDON	UK	Health Tech & Digital Tech
COPENHAGEN	Scandinavia	Health Tech & Climate Tech
MUNICH	DACH region (Germany, Austria, Switzerland)	Digital Tech & Health Tech
MUMBAI	India	Digital Tech
SINGAPORE	South & Southeast Asia	Digital Tech & Climate Tech
GUANGZHOU	Pearl River Delta – China	Digital Tech
TOKYO	Japan	Health Tech & Digital Tech

2.1.3 EWI DEPARTMENT

The EWI Department manages several multi-annual agreements and their accompanying budgets to implement actions within the framework of the **United Nations** (UN). These are:

- the Flanders UNESCO Trust Fund (FUST);
- the UNU-CRIS (United Nations University - Centre for Regional Integration Studies).

The EWI Department prepares and monitors the **memoranda of understanding (MoU)** that are concluded directly between the administrations or ministers charged with R&D&I. During ministerial missions abroad or during the official visits of foreign delegations to the Flemish minister or to public EWI entities, such agreements may be discussed and/or signed officially.

In some cases, **treaties** that include topics relating to scientific research exist or are being prepared between Belgium and another country. These may impinge on Flemish competencies in the field of STI. Whenever it is required, the EWI Department acts as the responsible entity to monitor such agreements.

The EWI Department also hosts, or is part of the Flemish delegation, during **visits from foreign authorities, delegations and multilateral authorities**. Conversely, it can be a part of, or represented in, Flanders' delegations abroad.

Through initiatives as the "**Flanders Inspires International Visitors Programme" (FIIVP)**, the EWI Department presents Flanders' strengths in the fields of economy, science and innovation, and learns from other countries and regions. The FIIVP has been on-going since 2010 and is inspired by the US "International Visitor Leadership Programme". Its aim is to establish long-term relationships with high-level international opinion makers and decision makers by organising (once or twice a year), a broad multi-sectoral programme, usually focussed on a specific theme. Visitors come from all over the world and represent a region, country, or institution from the EU (or an international organisation).

2.2 INTERNATIONAL ORGANISATIONS

In addition to the EU level Flanders also has representative functions linked to the preparation and follow-up of the policy-making of various international organisations. This includes the Organisation for Economic Cooperation and Development (OECD) and the United Nations (UN). More precisely:

- **OECD**: participation in the Global Science Forum, Steel Forum, the Committee on Science and Technological Innovation Policy (CSTP), the Technology and Innovation Policy (TIP), National Experts on Science and Technology Indicators group (NESTI), Working Party on Biotechnology, Nanotechnology and Converging Technologies (BNCT) and in thematic subgroups on e.g. ICT, biotechnology, and researchers' mobility. A substantial contribution is provided for the OECD's STIP Compass.
- **UN**: support for the Flanders UNESCO Science Trust Fund (FUST: capacity building in development countries), the Flanders UNIDO Science Trust Fund for Industrial Biotechnology (FUSTIB), United Nations University – Centre for Regional Integration Studies (UNU-CRIS) and the project office of the Inter-governmental Oceanographic Commission (IOC) for IODE at Ostend, for which EWI manages the financial support.
- **NATO**: the Flemish Government decided in 2023 to contribute to two NATO initiatives, namely the Defence Innovation Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund. DIANA focuses on dual-use technologies for solving security and defense issues. These technologies are, among others, located in the domains of AI, big data and cloud computing, hypersonic systems, quantum and biotechnology. Three Flemish Strategic Research Centers (SRC) will act as a test center, where organizations within the NATO Alliance can conduct testing, evaluation, verification and validation of their technologies in close collaboration with the respective SRC. The NATO Innovation Fund is the world's first multi-sovereign venture capital fund. The fund will invest €1 billion in early-stage start-ups and other venture capital funds working on emerging and disruptive dual-use technologies that are a priority for NATO. This contribution was decided as part of a wider government ambition to bring more support to the Flemish defense industry and defense research.

2.3 INTERNATIONAL ACTIVITIES FROM RESEARCH ORGANISATIONS

Many institutions and organisations in the field of STI have developed international links, ranging from network memberships over joint initiatives to bilateral agreements and foreign representation. Such initiatives are the result of a gradual trend towards greater internationalisation, whereby companies, universities, research institutes or knowledge centres develop bottom-up cooperation with foreign partners.

All five universities of the Flemish Community have developed partnership and cooperation agreements with research organisations worldwide and take part in international networks and programmes. Examples include the Coimbra Group (KU Leuven), the Santander Group (UGent), the University Consortium International (UHasselt) and the Utrecht Network (UA). All five universities are a member of the European University Association (EUA). On top of that, they are part of several other international initiatives aiming to shape EU policy, such as the League of European Research Universities – LERU (KU Leuven), The Guild (UGent) and the Young European Research Universities Network – Yerun (UA).

Among the Flemish **strategic research centres**, imec in particular has been very active at the international level. Apart from its home-based offices in Leuven and Ieper, it has also agencies in the Netherlands, Taiwan, China, India, the US and Japan. VITO has activities and representations in China, India and the Middle East. VIB has set up initiatives such as EU-life and Core For Life. Eu-life is an alliance of top research centres in life sciences to support and strengthen European research excellence. Core4Life aims at exploring the potential of coordinating and bundling core facility expertise and resources across institutes and countries to advance knowledge and to benefit the entire scientific and technological community.


© Reptile8488

VLIZ concludes cooperation agreements with international universities, research institutions and individual research groups, and participates in international networks and projects in the field of marine sciences. ITG works with many scientific institutions, governments and organisations all over the world for the long-lasting improvement of health care and disease control in developing countries.

In addition to the above examples of universities and (strategic) research centres, all other knowledge centres and organisations in Flanders cooperate with international partners in various initiatives, networks or actions.

3 GOVERNMENT SUPPORT FOR INTERNATIONAL ACTIVITIES

3.1 FWO-INSTRUMENTS

The actions of FWO are crucial to stimulate internationalisation of research and relate to: international mobility including research projects, international collaboration, international contacts, European programmes and involvement in international policy.

3.1.1 INTERNATIONAL MOBILITY

Incoming:

- Odysseus programme: a "brain-gain" programme to attract Flemish and other top and very promising researchers from around the world (back) to the universities of the Flemish Community;
- Grant for a scientific stay in Flanders: researchers can come for 1 to 3 months to a Flemish research institution for a collaboration on invitation of a researchers in a Flemish research institution.

Outgoing:

- Several grants or fellowships, both for conferences, workshops, courses, short stays as well as for longer stays abroad.

3.1.2 INTERNATIONAL COLLABORATION

- **Weave**: bottom-up cross-European initiative developed by European research funders to support excellent European collaborative research projects across national and regional borders, based on the **Lead Agency Principle**. There are agreements with cooperation with Austria (FWF), the French-speaking Community of Belgium (F.R.S.-FNRS), Germany (DFG), Luxembourg (FNR), Poland (NCN), Slovenia (ARIS), Sweden (Formas) and/or Switzerland (SNSF);
- **Scientific cooperation and exchange of researchers**: agreements with a number of countries for the funding of potential exchange projects and/or of exchange of researchers, namely with: Japan, China, Brazil, Argentina, France, South-Korea, Taiwan, Turkey, Mexico, France-Tournesol;
- **Bilateral research cooperation**: with Brazil, China, Vietnam, South-Africa, Québec (Canada);
- **International research infrastructure**:: this programme supports researchers at institutes of the Flemish Community who want to conduct research projects at major international research facilities, the membership for which is paid for by the Belgian Federal or Flemish government.

3.2 INTERNATIONAL CONTACTS

- **International Coordination Action**: support for coordination activities of international collaborative associations (i.e. those created in the context of multilateral and supranational entities such as EU, OECD, UN, UNESCO, WHO...);
- **Organisation of scientific meetings in Belgium**: support for researchers for the organisation of scientific conferences where the international and inter-university dimension is a central element of the programme;
- **Scientific Research Network**: support for researchers with the coordination of scientific research networks (= international networks of researchers that encourage national and international cooperation at postdoctoral level).

3.2.1 EUROPEAN PROGRAMMES

FWO acts as National Contact Point (NCP) in Horizon Europe (along with VLAIO) and for COST (along with the EWI Department). FWO also participates in joint calls for ERA-Nets, funds excellent ERC-applicants who have obtained a Seal of Excellence and provides a "top-up" budget for participations (of on-going FWO projects) into joint calls for Joint Programming Initiatives.

3.2.2
INVOLVEMENT IN INTERNATIONAL POLICY

The FWO cooperates with its European and international sister organisations in various networks and with other European research organisations or similar institutions; for example, the European Science Foundation (ESF), Science Europe, CECAM and the ECT.

3.3
VLAIO SUPPORT

VLAIO is the **National Contact Point (NCP)** for Flanders for supporting applications relating to thematic programmes within the Framework Programme for Research & Innovation, the ERA-nets, EUREKA, some Joint Technology Initiatives (JTIs), and initiatives which have phased-out such as INNO-nets. Moreover, VLAIO shares best practices with other European agencies in the innovation domain (such as TEKES from Finland or VINNOVA from Sweden) and is involved in various international networks and actions. For example, it is a member of the Association for Technology Implementation in Europe (**TAFTIE**), which fosters an exchange of best practice between the leading government innovation agencies supporting innovation in Europe.

In the field of international innovation, VLAIO also provides co- funding for participants from Flanders to take part in European projects, e.g. **EUREKA projects**. EUREKA is an inter-governmental initiative to promote international cooperation through projects (as well as clusters and "umbrellas") for applied and market- oriented industrial R&D, based on a bottom-up principle. After a quality check, the projects that are approved receive a EUREKA label. Participants from Flanders in the Eurostars innovation programme, which is aimed at innovative cross-border SMEs, arelikewise supported by VLAIO. The agency is involved in the daily management of the EUREKA-network and the representation in the management entities of EUREKA, Eurostars and the EUREKA- clusters.

In the field of international cooperation via the **EU Regional Development Fund**, there are several ERDF-Interreg initiatives in which STI actors, public authorities and private partners from Flanders jointly support(ed) multi-annual projects. Examples of past and current projects are BioBase Europe, Waterstofregio Vlaanderen - Zuid-Nederland (Hydrogen Region Flanders - South Netherlands), Hydrogen Network 2.0, CrossRoads2, Link2Innovate and Crosscare. Furthermore, cooperation with the neighbouring regions of North Brabant (the Netherlands) and North Rhine-Westphalia (Germany) takes place within the framework of the ELAt (Eindhoven-Leuven-Aachen triangle). In recent years, collaboration has been extended to the domain of sustainable chemistry.

The **Enterprise Europe Network (EEN)** Flanders consists of VLAIO and FIT (Flanders Investment and Trade), and provides companies with information about (innovative) internationalisation.


© Wirestock

ANNEX I

BELGIAN INSTITUTIONAL CONTEXT

1

FEDERALISM IN BELGIUM[19]

Belgium has **two types of federated entities**: Regions and Communities. That is why our state structure is so complicated. The country was divided into regions and communities because the Flemings and Walloons wanted a federal state for different reasons.

- Flemish citizens pursued cultural autonomy for all Dutch speakers, as well as for Flemish citizens living in Brussels. That is why three Communities were created: the Flemish Community, the French Community and the German-speaking Community. The word 'community' refers to the population group, which must be able to make decisions independently.
- The Walloons mainly wanted to pursue their own social-economic policy. For this reason, three Regions were created: the Flemish Region, the Brussels-Capital Region and the Walloon Region. The word 'region' refers to the territory.

The Belgian form of federalism is unique in the world. Its **main characteristics** are briefly:

- each entity has exclusive powers and competencies in various areas (no shared competencies);
- each entity has its own separately elected parliament, government, administration, legislation, advisory bodies, etc.;
- no hierarchy exists between the different entities regarding their competencies (no overruling is possible);
- since the fourth state reform of 1993, the principle of "in foro interno, in foro externo" has been applied, meaning that each entity executes its competencies both inside and outside Belgium.

19 *Source*: https://www.belgium.be/nl/over_belgie/overheid/federale_staat *(4 February 2020)*

1.1 THE COMMUNITIES

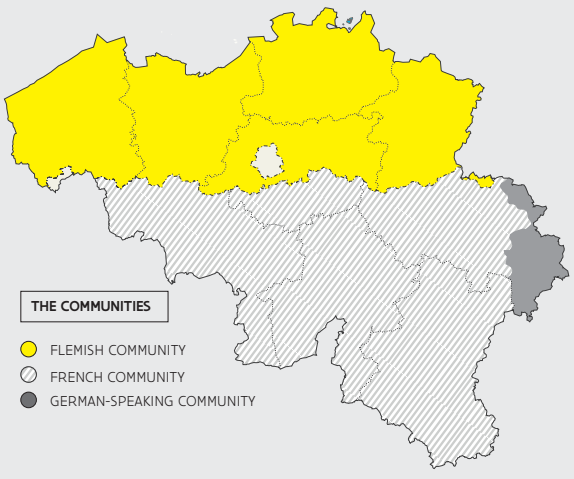
Belgium is divided into a Flemish, a French and a German-speaking Community.

- The Flemish Community comprises all the inhabitants of Flanders and Brussels-based Flemings. Brussels Flemings live in the bilingual Brussels-Capital Region and speak Dutch.
- The French Community comprises all the residents of Wallonia and French-speaking inhabitants of Brussels.
- The German-speaking Community comprises all the inhabitants of the nine German-speaking municipalities in the east of Belgium.

Each community has its own legislative body, and its own government.

COMMUNITIES IN BELGIUM

Figure 14



1.2 THE REGIONS

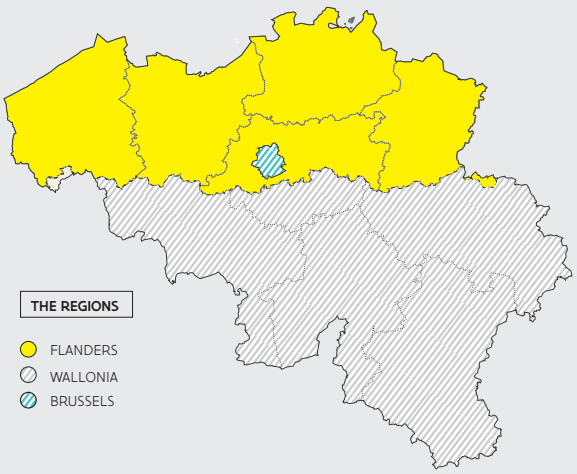
In addition, Belgium is divided into three Regions: the Flemish and Walloon Regions and the Brussels-Capital Region.

- The **Flemish Region** is made up of the territory of the five Flemish provinces.
- The **Walloon Region** encompasses the territory of the five Walloon provinces. There are also nine German-speaking municipalities in the Walloon Region. They do not constitute a German-speaking region.
- The **Brussels-Capital Region** encompasses the territory of the nineteen municipalities of Brussels.

Each region has its own legislative body, and its own government. The regional governments and legislative bodies decide upon matters such as housing, economy, transportation, public works, the environment, spatial planning, energy, land use etc.

REGIONS IN BELGIUM

Figure 15

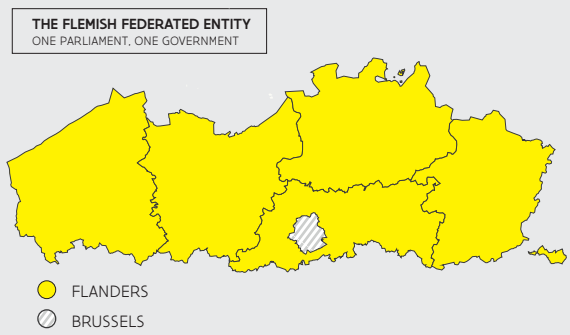


1.3 ONE FLEMISH GOVERNMENT

Contrary to the Walloon side, the Flemish community and the Flemish region were immediately combined into one Flemish federated entity, with one Flemish Parliament and one Flemish Government. This single government and parliament can decide on all matters in Flanders and on all matters pertaining to the Flemish community in Brussels.

THE FLEMISH FEDERATED ENTITY

Figure 16

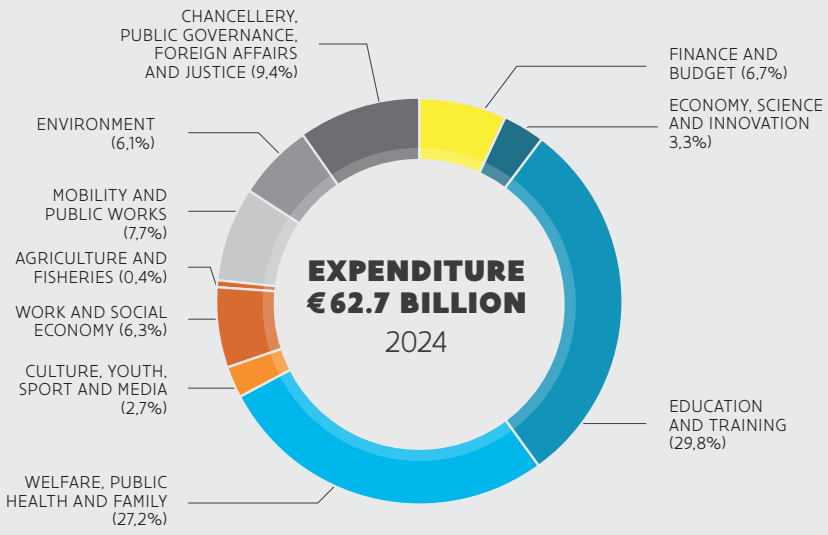


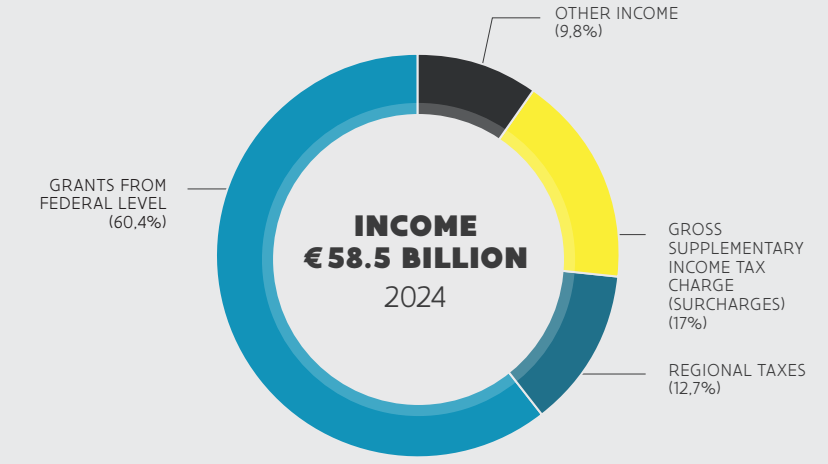
1.4 BUDGET

Flanders' budget in 2023 amounts to 62.7 billion euro. Its budget is for the biggest part funded by federal government resources. Flemish (supplementary) taxes make up approximately one third of the revenue. Expenditure-wise the bulk is spent on the policy areas Education and Training and Welfare, Public Health and Family. The policy area Economy, Science and Innovation is responsible for 3.3% of Flanders' expenditure.

BUDGET OF THE FLEMISH GOVERNMENT IN EUROS[20]

Figure 17





20 *Source: "Welcome to the Flemish Parliament"* (www.yumpu.com/en/document/read/63047400/vp-a5-brochure-en-v28012020-druk)

1.5 COMPETENCIES OF THE FLEMISH GOVERNMENT[21]

The Flemish Government makes decisions about aspects of people's lives. This means that it has a huge influence over the life of every Flemish citizen (environment, schools, welfare and so on). This is **an overview of the areas on which the Flemish Parliament can legislate.**

COMPENTENCIES OF THE FLEMISH GOVERNMENT

Table 4

PERSONAL ASSISTANCE	HEALTH CARE	CULTURE
• youth protection • youth policy • family policy (Child & Family) • family allowance, child birth allowances and adoption allowances • child care • policies for the elderly and the disabled • equal opportunities policies and the Equal Opportunities Centre • the integration of immigrants	• hospital policy • preventive health policy • home care • policy for the elderly and homes for the elderly • mental well-being • assistance to disabled persons	• arts • cultural heritage • museums • libraries • media (the Flemish Public Broadcaster VRT) • sports and tourism

LANGUAGE LEGISLATION	EDUCATION	ENVIRONMENT AND WATER POLICY
• use of languages by the authorities • use of languages in the business community	• all aspects of educational policy • except for a small number of matters such as compulsory education and teachers' pensions which are a federal competence	• environmental protection • waste management (Public Waste Agency of Flanders OVAM) • drinking water • waste water purification • sewage systems

21 Source: Flemish Parliament (http://www.flemishparliament.eu/about-the-flemish-parliament/what-are-the-devolved-competences-the-flemish-parliament)

MUNICIPALITIES AND PROVINCES	PUBLIC WORKS, MOBILITY AND TRAFFIC SAFETY	EMPLOYMENT
• financial resources • administrative supervision	• roads • waterways and inland navigation • seaports • regional airports • regional transport (public transport agency De Lijn) • Belgian institute for traffic safety and technical inspection • driving instruction, driving schools and exam centres	• labour market policy and employment (Flemish Service for Employment and Vocational Training VDAB) • employment programmes

ECONOMY	ENERGY	AGRICULTURE AND SEA FISHERIES
• support to companies • permits for trading establishments • foreign trade • statistical research • professional qualifications • commercial rental legislation	• distribution of electricity and natural gas • promotion of rational energy consumption	• support to agricultural and horticultural companies

LAND-USE PLANNING AND NATURE CONSERVATION	HOUSING	SPATIAL PLANNING
• land consolidation • parks • forest • hunting • fisheries • animal welfare	• building of social housing • financial housing support • rental of commercial and residential properties, leases, expropriations	• town and country planning • building permits • urban renewal • monuments and landscapes

FOREIGN AFFAIRS		
• international treaties regarding Flanders' competences • Cooperative development • foreign trade		

FLEMISH PROMOTION CENTRE FOR THE MARKETING OF AGRICULTURE, HORTICULTURE AND FISHERIES (VLAM)	SCIENTIFIC RESEARCH ABOUT THE FLEMISH COMPETENCES	JUSTICE POLICY FOR THE FLEMISH COMPETENCES

ANNEX II

MAIN R&D&I ACTORS

PUBLIC AUTHORITY

Department of Economy, Science and Innovation
www.ewi-vlaanderen.be/en

Department Chancellery and Foreign Affairs
www.fdfa.be/en

Research Foundation Flanders (FWO)
www.fwo.be/en

Flanders Innovation and Entrepreneurship (VLAIO)
www.vlaio.be/en

Flanders Holding Company (PMV)
www.pmv.eu/en

Limburg Reconversion Company (LRM)
www.lrm.be/en

Flanders Investment and Trade (FIT)
www.flandersinvestmentandtrade.com/en

ADVISORY COUNCILS

Flemish Advisory Council for Innovation and Entrepreneurship (VARIO)
www.vario.be/en

Social and Economic Council of Flanders (SERV)
www.serv.be/en/serv

SCIENTIFIC INSTITUTES (FROM THE FLEMISH COMMUNITY)

Agency Botanic Garden Meise
www.plantentuinmeise.be/en

Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)
www.ilvo.vlaanderen.be/en

Research Institute for Nature and Forest (INBO)
www.inbo.be/en

Royal Museum of Fine Arts Antwerp (KMSKA)
www.kmska.be/en

Flanders Heritage Agency (AOE)
www.onroerenderfgoed.be

OTHER KNOWLEDGE INSTITUTES

Flanders Marine Institute (VLIZ)
www.vliz.be/en

Institute for Tropical Medicine (ITM)
www.itg.be/en

Antwerp Zoo Centre for Research and Conservation (CRC)
www.zooscience.be

Alamire Foundation
www.alamirefoundation.org/nl/

Orpheus Institute
https://orpheusinstituut.be/en/

FEDERAL SCIENTIFIC INSTITUTES

Belgian Institute for Space Aeronomy (BIRA)
www.aeronomie.be/en

National Library of Belgium (KBR)
www.kbr.be/en

Royal Belgian Institute of Natural Sciences (KBIN)
www.naturalsciences.be

Royal Institute for Cultural Heritage (KIK)
www.kikirpa.be

Royal Meteorological Institute of Belgium (KMI)
www.meteo.be/en/belgium

Royal Museum for Central Africa
www.africamuseum.be/en

Royal Museums of Art and History (KMKG)
www.kmkg-mrah.be

Royal Museums of Fine Arts of Belgium (KMSK)
www.fine-arts-museum.be/en

Royal Observatory of Belgium (KSB)
www.astro.oma.be/en

State Archives of Belgium
www.arch.be

FEDERAL RESEARCH CENTRES

Sciensano
www.sciensano.be/en

National Institute for Radio-elements (IRE)
www.ire.eu

Belgian Nuclear Research Centre (SCK CEN)
www.sckcen.be/en

INTERNATIONAL INSTITUTES, ORGANISATIONS OR PLATFORMS IN THE STI FIELD, LOCATED IN FLANDERS

JRC - Institute for Reference Materials and Measurements (IRMM)
www.conffidence.eu/participants/ec-jrc-irmm

EU Joint Technology Initiatives (IMI, Clean Sky, ECSEL, FCH)
https://www.era-learn.eu/partnerships-in-a-nutshell/type-of-networks/partnerships-under-horizon-2020/public-private-partnerships-other-era-relevant-partnerships#JU

European Cooperation in Science and Technology (COST)
www.cost.eu

ESA Business and Innovation Centre (ESA BIC)
www.sbicnoordwijk.nl/esa-bic

United Nations University Institute on Comparative Regional Integration Studies (UNU-CRIS)
www.cris.unu.edu

European Marine Observation and Data Network (EMODnet)
www.emodnet.eu

European Marine Board (EMB)
www.marineboard.eu

Von Karmann Institute (VKI)
www.vki.ac.be

OTHER BODIES OF PUBLIC INTEREST IN THE FIELD OF SCIENCE AND INNOVATION

Royal Flemish Academy of Belgium for Arts and Sciences (KVAB)
www.kvab.be

Royal Academy of Belgium for Medicine (KAGB)
www.academiegeneeskunde.be

Royal Academy for Dutch Language and Literature (KANTL)
www.kantl.be

Flanders Foundation for Technology Assessment in Innovation and Work (STV voor Innovatie en Arbeid)
www.serv.be/en/stichting

Flemish Academic Centre for Science and the Arts (VLAST)
www.kvab.be/nl/vlast

Flanders Hydraulics
https://www.waterbouwkundiglaboratorium.be/en

UNIVERSITY ASSOCIATIONS

Antwerp
www.auha.be/en

Brussels
www.universitaireassociatiebrussel.be/en

Ghent
www.augent.be/en

KU Leuven
www.associatie.kuleuven.be/eng

Limburg
www.auhl.be

STRATEGIC RESEARCH CENTRES

Interuniversity Micro-electronics Centre (imec)
www.imec.be

Flanders Make
www.flandersmake.be

Flemish Institute for Biotechnology (VIB)
www.vib.be

Flemish Institute for Technological Research (VITO)
www.vito.be

TECHNOLOGY TRANSFER OFFICES (TTO) AT THE UNIVERSITIES AND THE STRATEGIC RESEARCH CENTRES

KU Leuven Research & Development
www.lrd.kuleuven.be/en

UGent TechTransfer
www.ugent.be/techtransfer/en

VUB TechTransfer
www.vubtechtransfer.be

AUHA Interfacedienst
www.uantwerpen.be/nl/onderzoek/informatie-voor-bedrijven

UHasselt Tech Transfer Office
www.uhasselt.be/techtransfer_en

The TTO's of the 4 strategic research centres
www.ttoflanders.be

COLLECTIVE RESEARCH CENTRES AND EQUIVALENT INSTITUTES

Belgian Institute for Wood Technology and Wood Training Centre (Wood.be)
www.wood.be

Belgian Welding Institute (BWI)
www.bil-ibs.be

Belgian Research Centre for the Cement Industry (CRIC)
www.cric.be

Belgian Road Research Centre (BRRC)
www.brrc.be

Scientific and Technical Service Centre for the Belgian Textile Industry (Centexbel)
www.centexbel.be/en

Belgian Building Research Institute (BBRI)
www.bbri.be

Scientific and Technological Research Centre for Diamond
www.wtocd.be

Collective Centre for the Belgian Technology Industry (SIRRIS)
www.sirris.be

Belgian Ceramic Research Centre (BCRC)
www.bcrc.be

Metallurgic Research Centre (CRM) (ferro and non-ferro)
www.crmgroup.be/en

Coatings Research Institute (CORI)
www.cori-coatings.be

Tecnolec / Volta (electrical business)
www.volta-org.be/nl

INTERDISCIPLINARY RESEARCH COOPERATION INITIATIVES

Energyville
www.energyville.be/en

Neuro-electronics Research Flanders (NERF)
www.nerf.be/about-us

SCIENCE / TECHNOLOGY PARKS

Tech Lane Ghent Science Park (previously the Ardoyen and Eiland Zwijnaarde parks) (Ghent)
www.techlane.be

Zellik (Asse)
www.researchparkzellik.be

Arenberg, Haasrode (Leuven)
www.wetenschapspark-arenberg.be

Feed Food Health (Tienen)
www.foodport.be

Thor Park (Genk)
www.thorpark.be

Corda Campus (previously Research Campus Hasselt) (Hasselt)
www.cordacampus.com/en

Ostend Science Park
https://ostendsciencepark.be/

INNOVATION CENTRES AND INCUBATORS

For an overview:

www.vlaio.be/nl/andere-doelgroepen/foreign-investors/information-foreign-investors/finding-right-location

SPEARHEAD CLUSTERS

Sustainable chemistry and synthetics (Catalisti)
www.catalisti.be

Specialised Logistics (VIL)
www.vil.be

Agro-food (Flanders' Food)
www.flandersfood.com

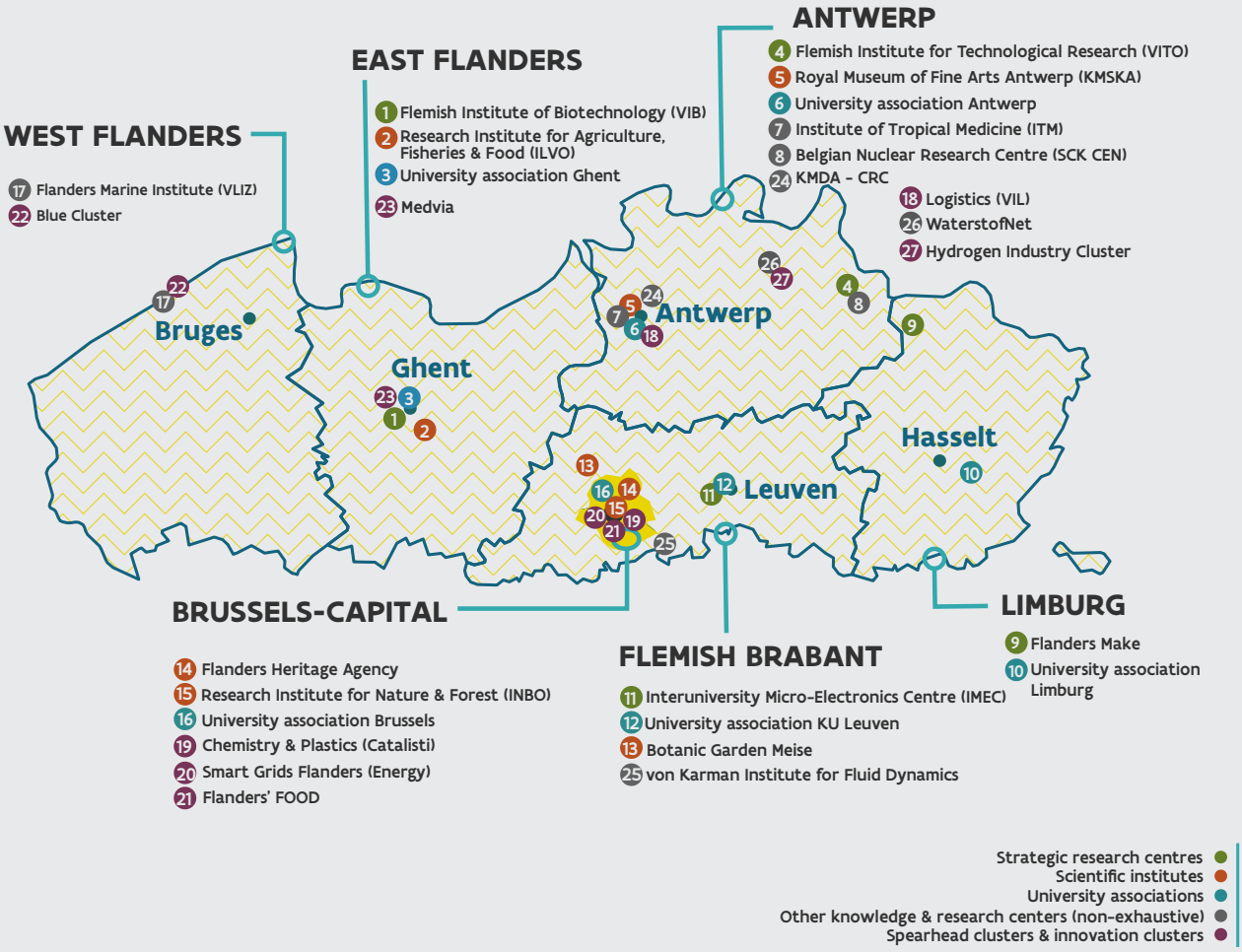
Crossover biotech, medical and digital technologies (Medvia)
www.medvia.be

Sustainable North Sea economic activities (Blue cluster)
www.blauwecluster.be

Energy and smart grids (Flux50)
www.flux50.com

MAIN RESEARCH AND ECONOMIC ACTORS IN THE FLEMISH STI-LANDSCAPE

Figure 18



ANNEX III

FUNDING OF R&D

1 INTRODUCTION

Investments in R&D are key to ensuring a high level of productivity and maintain competitiveness in a global perspective. R&D-investments are also expected to be crucial to tackle grand societal challenges such as the energy and climate transition or an ageing population. In its Innovation Pact of 2003 and on subsequent occasions (Pact 2020, Flanders in Action, Vision 2050) the Flemish Government has stated its ambition to reach a 3% R&D-intensity, thus subscribing to the Europe 2020 3%-target.

As will become clear in the following sections, the Flemish Government has made laudable efforts in pursuit of the 3%-target.

2 GERD

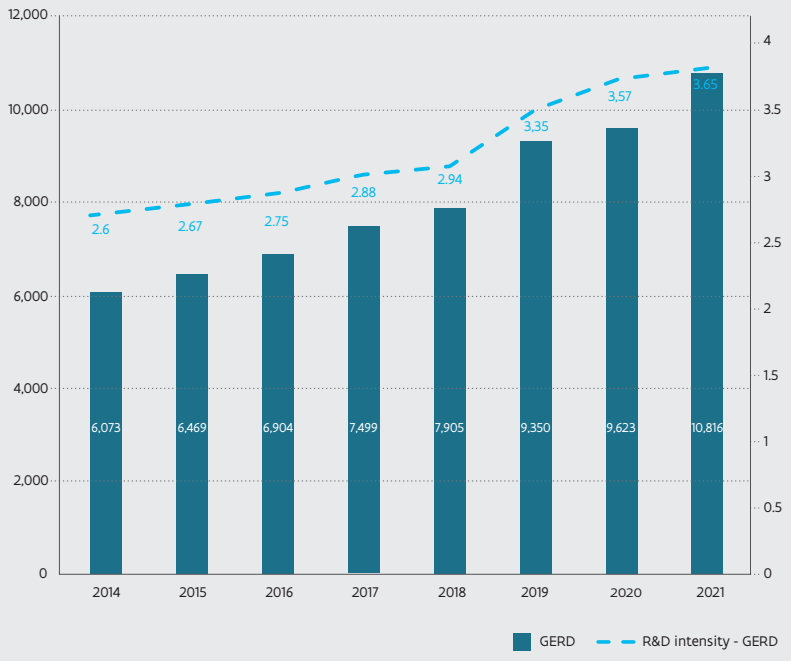
In 2021, Flanders spent over 10,816 million euros on R&D (GERD). More than 73% of the research cost was spent by companies (the Business Enterprise Sector or BES) and 27% by public research institutes (PNP, GOV and HES). The R&D effort for Flanders represented almost two-thirds of the GERD for the whole of Belgium in 2021.

The R&D intensity (measured as the percentage of GERD related to GDP) of Flanders was 3.35% in 2019 (compared to 2.75% in 2016, 2.88% in 2017 and 2.93% in 2018). Flanders reaches with this figure quite well above the Europe 2020 3% target and only Korea (4.93%) and Sweden rank still higher (3.39%). Flanders ranks higher than Austria, Germany, the USA and the EU-27 average.

When the total R&D intensity of the GERD (3.65% for 2021) is broken down by source of funding, 2.83% comes from private funds and 0.82% from public funds (federal, regional, community, European and international funds), which equates to 76% and 24% by private and public sectors respectively.

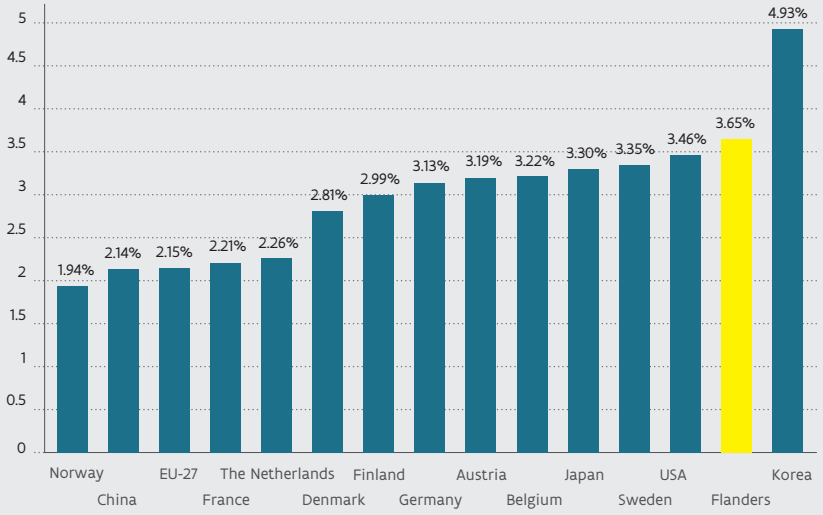
EVOLUTION OF TOTAL R&D SPENDING (GERD) AND THE R&D INTENSITY OF THE GERD IN FLANDERS FROM 2014 TO 2021, IN MILLION EUROS (CURRENT PRICES)

Figure 19



INTERNATIONAL COMPARISON OF THE R&D INTENSITY OF GERD FOR 2021

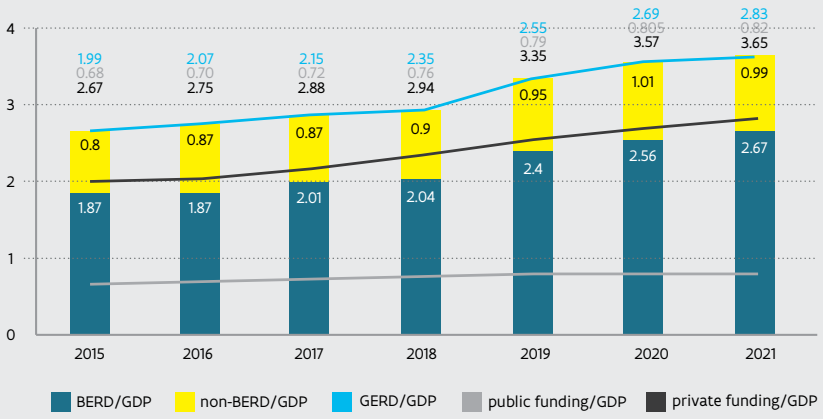
Figure 20



Source: OECD database, Main Science and Technology Indicators.
France, Denmark, USA: provisional figure: EU-27, Sweden : estimated value; definition differs

R&D INTENSITY BROKEN DOWN BY SECTOR OF PERFORMANCE OR SOURCE OF FUNDS FOR FLANDERS, 2015-2021

Figure 21



Source: OECD Main science and technology indicators,
Denmark provisional, EU27 estimate, USA provisional and definitions may differ

Investments in R&D are key to ensuring a high level of productivity and maintain competitiveness in a global perspective.

© Shutterstock


© Shutterstock

3 BERD

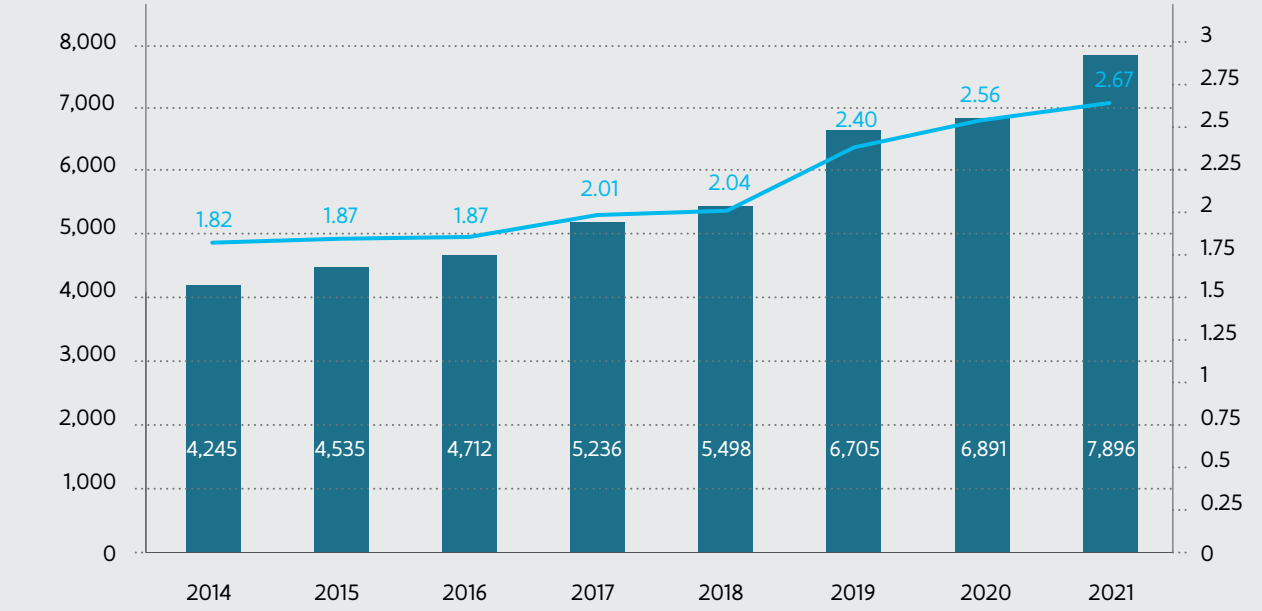
In 2021, the business enterprise sector spent 7,896 million euros on R&D activities in Flanders, measured at current prices. This is the (BERD), which corresponds to a R&D intensity (BERD as a % of GDP) of 2.67%. This level represents an increase for the GERD compared to 2018 (2.04%), 2019 (2.40%) and 2020 (2.56%). When the total R&D intensity of the BERD is broken down by source of funding, 2.54% comes from private funds and 0.13% from public funds (2021). The share of the BERD in the GERD was 73% in 2021.

The R&D activities (expenditure) within companies in Flanders are mainly focused on the following high-tech sectors (2021): chemicals and pharmaceuticals (NACE 20-21) account for 39% of total BERD expenditures on R&D (based on a sample); motion picture, video and TV production, computer programs, engineering, and technical testing and analysis activities (NACE 59-63, 71-72) account for about 23%; machinery and transport (NACE 28-30) account for about 8%; information technology, electronic products, optical products and electrical equipment (NACE 26-27) account for about 7%. In 2021, the R&D intensity in the business sector was 2.67%. Flanders therefore ranks higher than the EU-27 average, France, the Netherlands, Finland, Germany, Austria, Sweden and Japan, but lower than Korea.

.

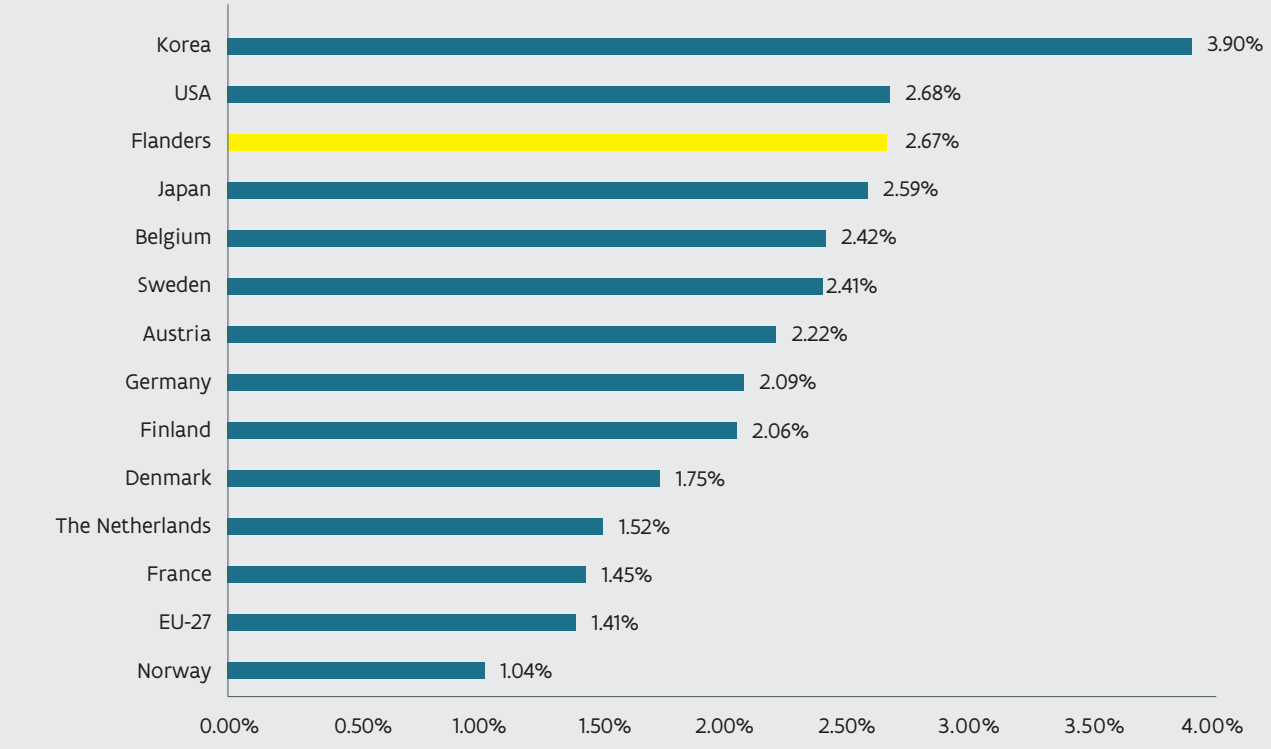
EVOLUTION OF THE R&D SPENDING BY COMPANIES (BERD) AND R&D INTENSITY FOR THE BERD, FROM 2014 TO 2021, IN MILLION EUROS (CURRENT PRICES)

Figure 22



INTERNATIONAL COMPARISON OF THE R&D INTENSITY OF BERD FOR 2021

Figure 23



Source: OECD Main science and technology indicators, Denmark provisional, EU27 estimate, USA provisional and definitions may differ

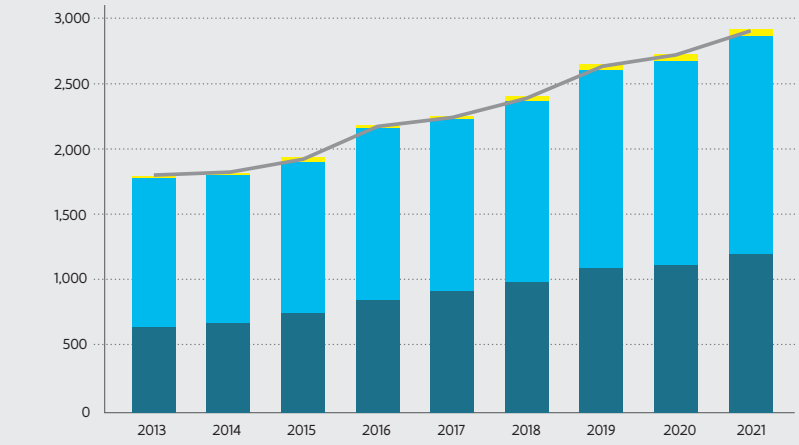
4 NON-BERD

Globally the share of R&D spending by the public sector within total R&D spending stays stable between 2016 and 2021. R&D spending by the public sector (non-BERD = GOVERD + HERD + PNP) amounted to 2,920 million euros in 2021. About 41% of this amount was spent by public research institutes (GOV) and 57% by higher education institutions (HES). There is an increase in the R&D expenditure (in absolute terms) of the public sector in 2020 and 2021. The R&D intensity for the public sector (non-BERD as a % of GDP) in Flanders amounted to 0.99% in 2021. After a stagnation between 2012 and 2015, a steady increase between 2016 and 2021 can be remarked. When the total R&D intensity of the non-BERD is broken down by source of 0.29% is funded privately and 0.69% by public funds (2021).

The GOVERD and HERD (2021) can be broken down by different fields of science. For the GOV sector, this indicates the dominant position of engineering and technology (69.4%). For the HES sector, the most important fields of science are the medical sciences (31.9%), engineering & technology (17.9%). the natural sciences (17.4%) and the social sciences (16.2%).

EVOLUTION OF THE R&D SPENDING BY GOV, HES AND PNP (NON-BERD=GOVERD+HERD+PNP), FROM 2013 TO 2021, IN MILLION EUROS (CURRENT PRICES)

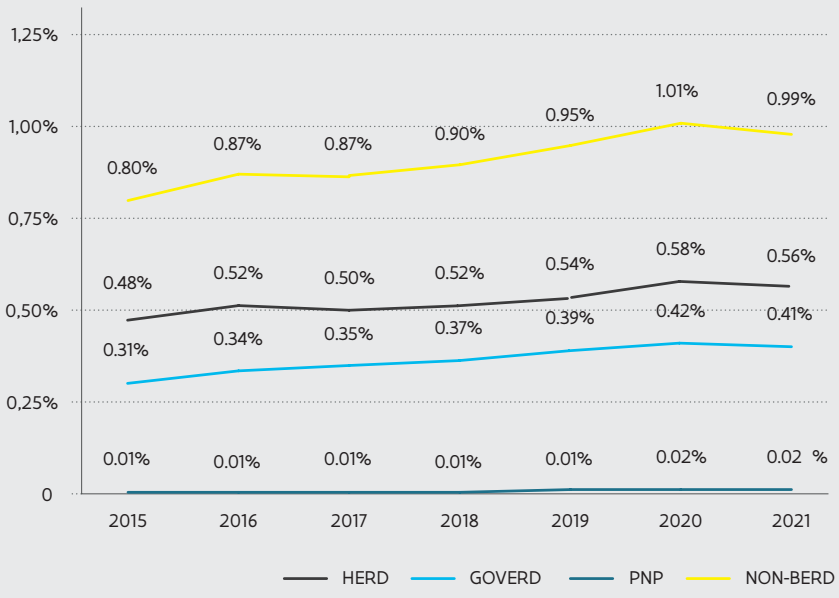
Figure 24



	2013	2014	2015	2016	2017	2018	2019	2020	2021
PNP	15	22	22	27	27	29	36	49	47
HERD	1,136	1,122	1,167	1,306	1,313	1,389	1,505	1,564	1,665
GOVERD	652	684	745	859	923	989	1,104	1,119	1,208
NON-BERD	1,803	1,828	1,934	2,191	2,263	2,407	2,645	2,732	2,920

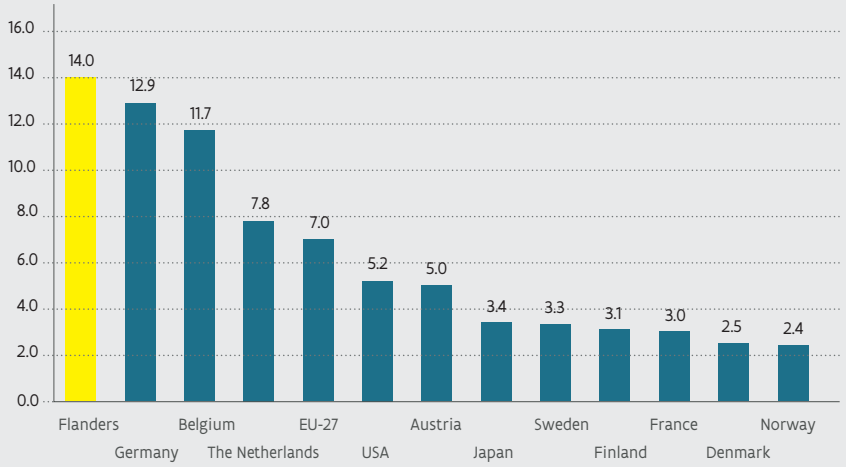
EVOLUTION OF THE R&D INTENSITY FOR THE NON-BERD (GOVERD, HERD AND PNP) FROM 2015 TO 2021

Figure 25



INTERNATIONAL COMPARISON OF THE FUNDING OF THE HERD BY COMPANIES FOR 2021, IN %.

Figure 26

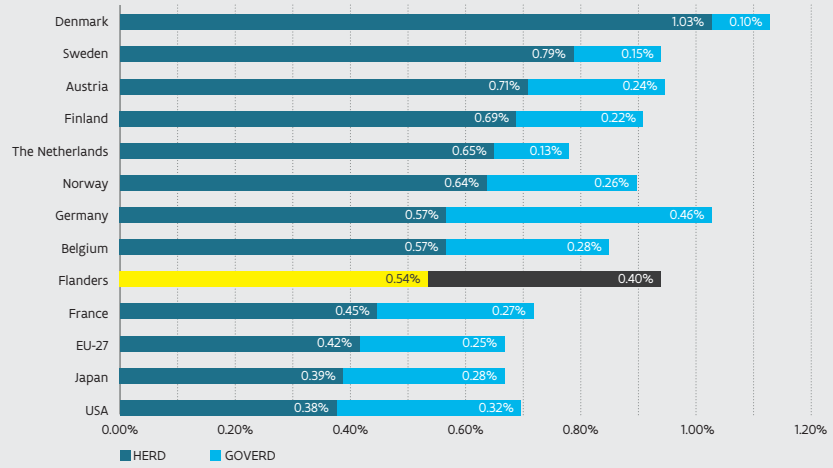


Source: OECD database, Main Science and Technology Indicators

EU-27: provisional figure; Norway: estimated value; Sweden: break in time series; US: definition differs; figure for Germany, Germany, the Netherlands, EU-27, USA, Finland, France , Denmark, Norway (2020) and Belgium, Austria, Sweden (2019)

INTERNATIONAL COMPARISON OF THE R&D INTENSITY OF HERD AND GOVERD FOR 2021

Figure 27



Source: OECD database, Main Science and Technology Indicators

Belgium, EU-27 and Austria: estimated value; USA, Germany (GOVERD) and the Netherlands (GOVERD): definition differs; figure for the Netherlands, Belgium and and Sweden (2020)

For the GOVERD, the most important source of funds in 2021 was abroad (54.6%), followed by government funding (38.8%) and thirdly the companies (7.5%). For the HERD, government funding was again the most important source of funds (69.4%), followed by the companies (14.0%) and abroad (8.7%). The proportion of the HERD that is supported by (domestic) companies for 2021 ranks higher internationally than any of the EU-27 countries and is more than twice the figure for the EU-27 as a whole. Only Germany has a similar proportion. In other words, companies are both an important client and an important source of funds for the research carried out at the Flemish higher education institutions.

For the R&D intensity of the HES, Flanders scores above France and the EU-27 average. Norway (0.64%), the Netherlands (0.65%), Finland (0.69%), Austria (0.71%), Sweden (0.79%) and Denmark (1.03%) have a much higher R&D intensity for the HES. The R&D intensity of the GOV is higher in Flanders than in Sweden, the Netherlands, Norway, Finland, Denmark, Austria, France and the EU-27 average. Flanders' results are lower than Germany. In summary, for both figures, Flanders is maintaining its international position.

5 GBARD

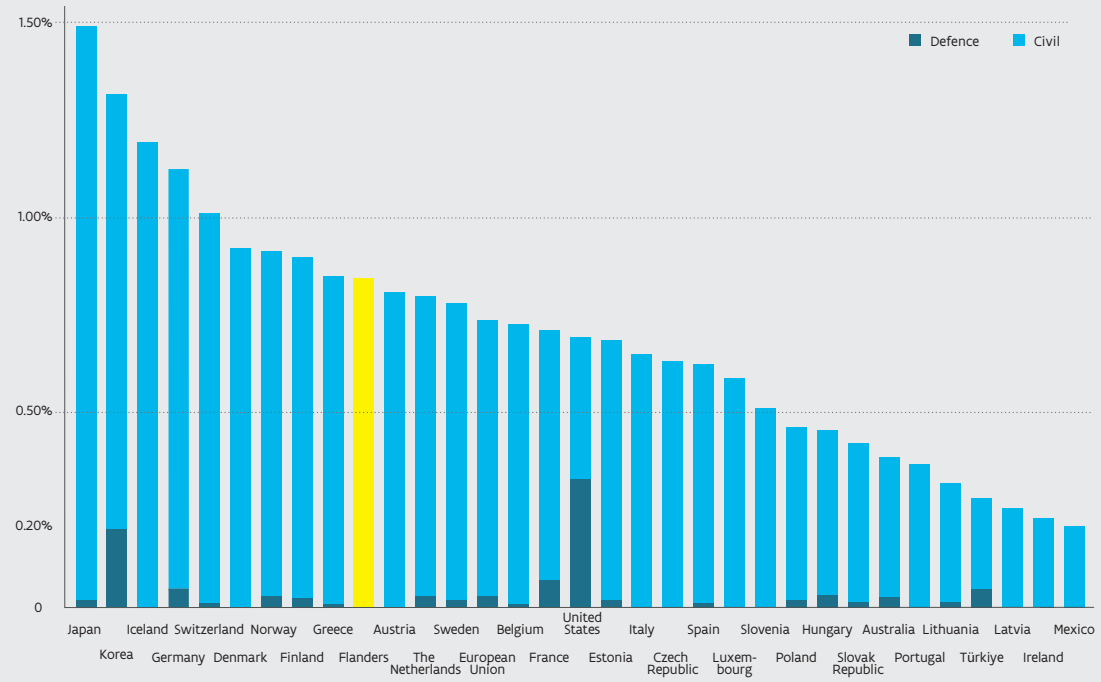
This section examines in detail the R&D support received from Flanders, in particular that of the Flemish government, and compares it with that of other countries. GBARD (Government Budget Appropriations for R&D) is an indicator used by the OECD and Eurostat. The table below shows an international comparison of the GBARD as a percentage of GDP. The calculation method of the Flemish figure is explained further in this chapter.

It is clear that the trends for GBARD, expressed as a percentage of GDP, differ between countries. In some countries there is stagnation; in others there is even a drop over a period of several years. Figure 28 compares Flanders with selected countries for 2021. Because of the worldwide financial and economic crisis, followed by measures taken for the benefit of the economy, it is necessary to proceed with caution when comparing budgets. The most recent year with data for all the compared countries is the year 2021 (Table 5).

Flemish Government R&D funding + Flemish share of the federal funding (35.5% ESA, 56% for the rest). Belgium figure: Commissie Federale Samenwerking. CFS/STAT: final budget Flanders + provisional budget other authorities).

INTERNATIONAL COMPARISON OF GOVERNMENT BUDGET APPROPRIATIONS OR OUTLAYS FOR R&D (GBARD) 2020. EXPRESSED AS A PERCENTAGE OF GDP(R)

Figure 28



Source: OECD database. Main Science and Technology Indicators
Flanders: Speurgids 2021

INTERNATIONAL COMPARISON OF GOVERNMENT BUDGET APPROPRIATIONS OR OUTLAYS FOR R&D (GBARD), EXPRESSED AS A PERCENTAGE OF GDP(R)

Table 5

COUNTRY	2015	2016	2017	2018	2019	2020	2021
COLOMBIA	0,10%	0,08%	0,09%	0,07%	0,07%	0,06%	
JAPAN	0,65%	0,66%	0,81%	0,86%	1,03%	1,71%	1,49%
KOREA	1,14%	1,10%	1,06%	1,04%	1,08%	1,25%	1,32%
ICELAND	0,85%	0,93%	0,95%	0,96%	0,91%		1,20%
GERMANY	0,88%	0,90%	0,92%	0,94%	0,98%	1,09%	1,12%
SWITZERLAND	0,88%		1,00%	0,94%	0,97%	1,05%	1,01%
DENMARK	1,00%	0,91%	0,89%	0,89%	0,89%	0,97%	0,92%
NORWAY	0,93%	0,99%	1,02%	0,98%	1,02%	1,14%	0,91%
FINLAND	0,95%	0,84%	0,83%	0,84%	0,84%	0,96%	0,89%
GREECE	0,52%	0,54%	0,50%	0,62%	0,70%	0,88%	0,85%
FLANDERS	**0,65%**	**0,67%**	**0,74%**	**0,72%**	**0,80%**	**0,81%**	**0,84%**
AUSTRIA	0,80%	0,80%	0,78%	0,76%	0,76%	0,86%	0,81%
NETHERLANDS	0,71%	0,70%	0,67%	0,71%	0,69%	0,76%	0,80%
SWEDEN	0,78%	0,78%	0,77%	0,75%	0,73%	0,76%	0,78%
EUROPEAN UNION – 27 COUNTRIES	**0,64%**	**0,63%**	**0,63%**	**0,64%**	**0,66%**	**0,74%**	**0,73%**
BELGIUM	0,61%	0,62%	0,66%	0,64%	0,69%	0,74%	0,73%
FRANCE	0,64%	0,63%	0,64%	0,66%	0,66%	0,74%	0,71%
UNITED STATES	0,63%	0,67%	0,65%	0,70%	0,70%	0,81%	0,69%
ESTONIA	0,68%	0,67%	0,60%	0,70%	0,63%	0,68%	0,69%
ITALY	0,51%	0,52%	0,51%	0,51%	0,55%	0,66%	0,65%
CZECH REPUBLIC	0,60%	0,58%	0,60%	0,62%	0,62%	0,67%	0,63%
UNITED KINGDOM	0,53%	0,52%	0,53%	0,55%	0,54%	0,66%	
SPAIN	0,56%	0,54%	0,52%	0,52%	0,52%	0,62%	0,62%
LUXEMBOURG	0,62%	0,60%	0,60%	0,59%	0,62%	0,57%	0,59%
ISRAEL	0,61%	0,61%	0,60%	0,61%	0,60%	0,66%	0,56%
NEW ZEALAND	0,50%	0,50%	0,52%				
CANADA	0,50%	0,50%	0,52%	0,49%	0,50%	0,57%	
SLOVENIA	0,41%	0,40%	0,40%	0,42%	0,45%	0,52%	0,51%
POLAND	0,41%	0,33%	0,36%	0,28%	0,44%	0,44%	0,46%
HUNGARY	0,28%	0,39%	0,35%	0,30%	0,27%	0,53%	0,45%
SLOVAK REPUBLIC	0,41%	0,37%	0,36%	0,37%	0,38%	0,41%	0,41%
AUSTRALIA	0,41%	0,39%	0,42%	0,39%	0,39%	0,45%	0,39%
PORTUGAL	0,38%	0,38%	0,37%	0,36%	0,35%	0,37%	0,36%
LITHUANIA	0,33%	0,31%	0,31%	0,29%	0,31%	0,33%	0,31%
TÜRKIYE	0,34%	0,35%	0,34%	0,35%	0,35%	0,28%	0,28%
LATVIA	0,19%	0,21%	0,22%	0,22%	0,22%	0,26%	0,25%
IRELAND	0,28%	0,27%	0,25%	0,23%	0,22%	0,23%	0,22%
CHILE	0,20%	0,22%	0,22%	0,22%	0,21%		
MEXICO	0,32%	0,28%	0,23%	0,22%	0,20%	0,21%	0,20%

Source: OECD database. Main Science and Technology Indicators

6
ESTIMATE CALCULATION METHOD FOR PUBLICLY FINANCED R&D INTENSITY (1% OBJECTIVE)

For the period after 2017, no R&D survey data by sector is yet available. A cautious estimate is being made of the growth path necessary to reach the 1% objective (the publicly financed share of the above mentioned 3% objective) by 2020. Consequently, for the present purpose, as in previous EWI Budget Browsers, a calculation is included to approximate the results of the most recent years.

The combined efforts of the government are calculated by elaborating different variants.

1. **The own efforts of the Flemish Government**
   This is the Flemish GBARD in the strict sense, funded by the Flemish Government only.

2. **The efforts of the Flemish Government + the Flemish share of federal government R&D funding**
   In Flanders, R&D activities are also funded by federal government R&D funds. When this share received from the federal government is added to the Flemish GBARD in the strict sense (1), a GBARD is obtained for Flanders that is probably closer to reality. This variant is consequently the most suitable for an international comparison of the GBARD. When calculating Flanders' share of federal government funding, the following formula is used: 35.5% of the funding from the European Space Agency (source: Flemish Council for Science and Innovation – VRWI) and 56% for the remainder of the total federal R&D funding.

3. **The efforts of the Flemish Government + the Flemish share of federal government R&D funding + the Flemish return from the funds of the EU Framework Programs for Research and Technological Development**
   In another variant, the Flemish return from the EU Framework Programs for Research and Technological Development can also be added, since this too represents R&D activities funded publicly. However, the result of this calculation can no longer be considered as GBARD, but is actually a third variant that can be used for calculating the publicly financed share of the R&D intensity.

The results of this calculation are given in the table. The figure for 2021, initial budget (i), is estimated at 0.93% of GDP(R).

EVOLUTION OF THE R&D BUDGET AND R&D INTENSITY

Table 6

BUDGET IN MILLION EURO	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Flemish Government[22]	1,227.57	1,236.01	1,243.50	1,397.77	1,298.43	1,394.71	1,597.69	1,625.73	1,951.59	1,858.01	2,172.97	2,081.08	2,149.1
Flemish Gov. + Flemish share of federal gov.[23]	1,511.54	1,533.79	1,544.56	1,693.07	1,576.34	1,677.08	1,937.19	1,924.22	2,238.36	2,188.43	2,491.78	2,404.87	2,479.36
Flemish Gov. + federal share + EU-FP[24]	1,662.5	1,721.19	1,757.55	1,822.43	1,815.38	1,939.76	2,151.4	2172.71	2540.7	2,510.57	2,702.19	2,696.84	2,671.03
BBPR (million euro)[25]	218,478.8	224,665.0	228,326.9	233,234.7	242,129.3	251,400.6	260648.1	268873.6	279424.6	269,439.2	296,131.1	324,846.9	341,448.8

PUBLIC R&D INTENSITY AS % OF GDP® (1% OBJECTIVE)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Flemish Government[22]	0.56%	0.55%	0.54%	0.6%	0.54%	0.55%	0.61%	0.6%	0.7%	0.69%	0.73%	0.64%	0.63%
Flemish Gov. + Flemish share of federal gov.[23]	0.69%	0.68%	0.68%	0.73%	0.65%	0.67%	0.74%	0.72%	0.8%	0.81%	0.84%	0.74%	0.73%
Flemish Gov. + federal share + EU-FP[24]	0.76%	0.77%	0.77%	0.78%	0.75%	0.77%	0.83%	0.81%	0.91%	0.93%	0.91%	0.83%	0.78%

22 *Flemish Government budget for R&D: final budgets 2009-2022; initial budget 2023.*

23 *Flemish share in the federal government R&D funds: ESA distribution key at 35.5% for Flanders (source: VRWI) and the remainder of federal government R&D funds estimated at 56% for Flanders. Federal government R&D funds: source: CFS/STAT; for 2022 and 2023i the initial budget of 2022 was used.*

24 *2008 – 2013: estimated return based on final results of the Flemish return for the Seventh Framework Programme – 2014 – 2020: estimated return based on final results of the Flemish return for the Horizon 2020. Sources: eCorda data, reworked by EWI.*

25 *GDP(R): Gross Domestic Product by Region. Source: 2009-2021 NBB; july-2023 Hermreg - Research Centre of the Flemish Government (Studiedienst van de Vlaamse Regering), July 2023.*

7

THE EU FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION (2021-2027) HORIZON EUROPE

7.1 INTRODUCTION

Horizon Europe, the current framework programme for research and innovation with a budget of €95.5 billion, is the EU programme with the largest budget for supporting research and innovation activities for the 2021-2027 period. This is an increase of 27% compared to the last framework programme Horizon 2020.

Horizon Europe is organised around four main pillars

1. Excellent Science: Activities under this pillar aim to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale.

2. Global Challenges & European Industrial Competitiveness: This pillar gathers six thematic clusters designed to boost key technologies and solutions underpinning EU policies & Sustainable Development.

3. Innovative Europe: This pillar combines three structures that stimulate market-creating breakthroughs and ecosystems conducive to innovation.

4. Widening Participation And Strengthening The European Research Area: this pillar combines activities to improve the European research Area, and to widen to the activities of the framework programme to all EU member states.

Within this framework, there are several new initiatives compared to the previous framework Horizon 2020:

- The European Innovation Council: The EIC is based in Pillar 3, and provides support for innovations with potential breakthrough and disruptive nature with scale-up potential that may be too risky for private investors.

- The Missions combine projects and measures to achieve bold, inspirational and measurable goals within a predetermined timeframe. Five missions have been defined around the topics Climate, Cancer, Cities, Oceans and Soil.

- Open science policy: The Horizon Europe programme requires mandatory open access to publications and open science principles are applied throughout the programme.

- Horizon Europe integrates a stronger approach to partnerships: The partnerships with industry are set up in support of EU policy objectives and are objective-driven and more ambitious.

The following table shows the structure of the Horizon Europe programme. For each element of the programme, the acquired budget of Flemish partners is indicated, together with the total budget that has already been allocated at EU-level.

The share of the total EU-budget for Flemish partners is calculated as the "return".

The data used in the present section were taken from the database that the European Commission makes available via the electronic platform e-CORDA. The release date of the data is 8th of August 2023.

HORIZON EUROPE PROGRAMME STRUCTURE

Table 7

I. EXCELLENT SCIENCE		EUR million in current prices **Allocation to FL partners**	EUR million in current prices **Total EU allocation**	% **Return (*)**
HORIZON.1.1	European Research Council (ERC)	172.8	5,637.9	3.06%
HORIZON.1.2	Marie Skłodowska-Curie Actions (MSCA)	77.7	1,820.9	4.27%
HORIZON.1.3	Research infrastructures	15.3	838.0	1.83%
II. GLOBAL CHALLENGES & EUROPEAN INDUSTRIAL COMPETITIVENESS (**)		EUR million in current prices **Allocation to FL partners**	EUR million in current prices **Total EU allocation**	% **Return (*)**
HORIZON.2.1	Health	92.1	2,567.3	3.59%
HORIZON.2.2	Culture, creativity and inclusive society	23.0	683.1	3.36%
HORIZON.2.3	Civil Security for Society	8.3	429.5	1.93%
HORIZON.2.4	Digital, Industry and Space	198.4	4,761.3	4.17%
HORIZON.2.5	Climate, Energy and Mobility	131.3	5,701.2	2.30%
HORIZON.2.6	Food, Bioeconomy Natural Resources, Agriculture and Environment	124.5	2,909.6	4.28%
III. INNOVATIVE EUROPE		EUR million in current prices **Allocation to FL partners**	EUR million in current prices **Total EU allocation**	% **Return (*)**
HORIZON.3.1	The European Innovation Council (EIC)	55.3	2,098.4	2.63%
HORIZON.3.2	European innovation ecosystems	1.5	130.5	1.14%
HORIZON.3.3	The European Institute of Innovation and Technology (EIT)	22.4	319.2	7.02%
IV. WIDENING PARTICIPATION AND STRENGTHENING THE EUROPEAN RESEARCH AREA		EUR million in current prices **Allocation to FL partners**	EUR million in current prices **Total EU allocation**	% **Return (*)**
HORIZON.4.1	Widening participation and spreading excellence	9.6	799.7	1.20%
HORIZON.4.2	Reforming and enhancing the European R&I System	3.0	163.7	1.86%
TOTAL		**935**	**28,860**	**3.24%**

(*) The region of Flanders hosts approximately 2% of the researchers in the EU. Also the regional and national investments in R&D mount to 2.24% of the EU-total. This indicates that a return of about 2% to 2.2% would indicate an average performance of the Flemish R&D-actors in a specific programme element. For most elements, the Flemish R&D-actors perform better, resulting in higher than average returns.

(**) The missions and partnerships are integrated in Pillar II, and are assigned to the corresponding thematic clusters.

7.2
PARTICIPATION BY FLANDERS

By now, Flanders participates 1.967 times in 1.444 projects in Horizon Europe. This equates to a total participation funding for Flanders of 935.1 million euros. Flanders is responsible for the major part of the total Belgian number of participations. projects and coordinators, as well as the largest share of the participation grants.

The total Flemish participation funding represents 3.28% of the total funding received from the European Commission for participating in Horizon Europe.

At present, the three thematic priorities with the highest number share of activities from knowledge actors in Flanders are Marie Curie (MSCA), HORIZON.2.4 Digital, Industry and Space and HORIZON.2.6 Food, Bioeconomy Natural Resources, Agriculture and Environment .

The largest contributions to Flemish actors have been accorded by the European Research Council (ERC), and for the clusters HORIZON.2.4 Digital, Industry and Space, and HORIZON.2.5 Climate, Energy and Mobility.


© ICOS

FLEMISH PARTICIPATION IN THE LAST FRAMEWORK PROGRAMMES

Table 8

	6KP	7KP	H2020	HORIZON EUROPE
Number of participations	1.342	2.884	4.155	1.967
Number of projects	1.051	2.232	2.939	1.444
Number of actors	422	490	614	369
Granted EU-budget to FL partners	352,3	1.125,0	1.895,1	935.1
Total EU-budget	16,6	44,9	69,0	28.5
RETURN (%)	**2,12%**	**2,50%**	**2,76%**	**3,28%**
REFERENCE AVERAGE RETURN	**1,48-1,74%**	**1,47-1,73%**	**2,04%**	**2,24%**

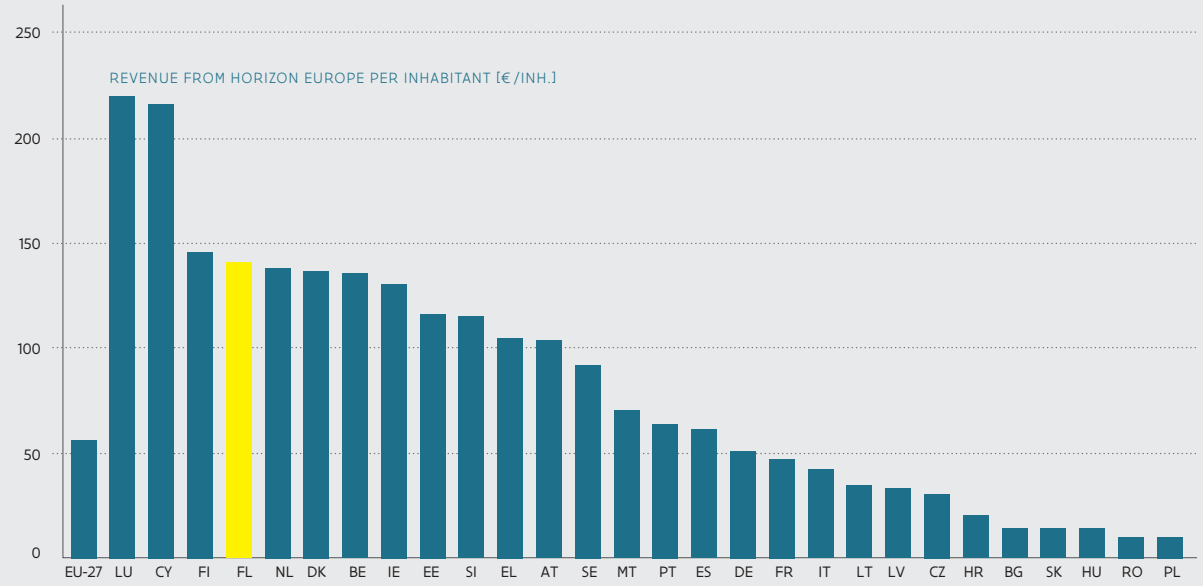
7.3
BENCHMARK FOR FLANDERS

The performance of Flanders in Horizon Europe is compared to the European member states in two ways. First, the total obtained contribution is divided by the Gross Domestic Product. The result shows the Horizon Europe funding for the first two years as a ‰ of the GDP of 2021. This index makes the performance of larger and smaller countries more comparable. The result shows that Flanders would rank in the 6th position, between the member states. Belgium as a whole is 7th.

The second comparison shows the obtained EC contribution per inhabitant. Flanders comes in a 4th position, between Finland and the Netherlands. Belgium as a whole ranks 7th.

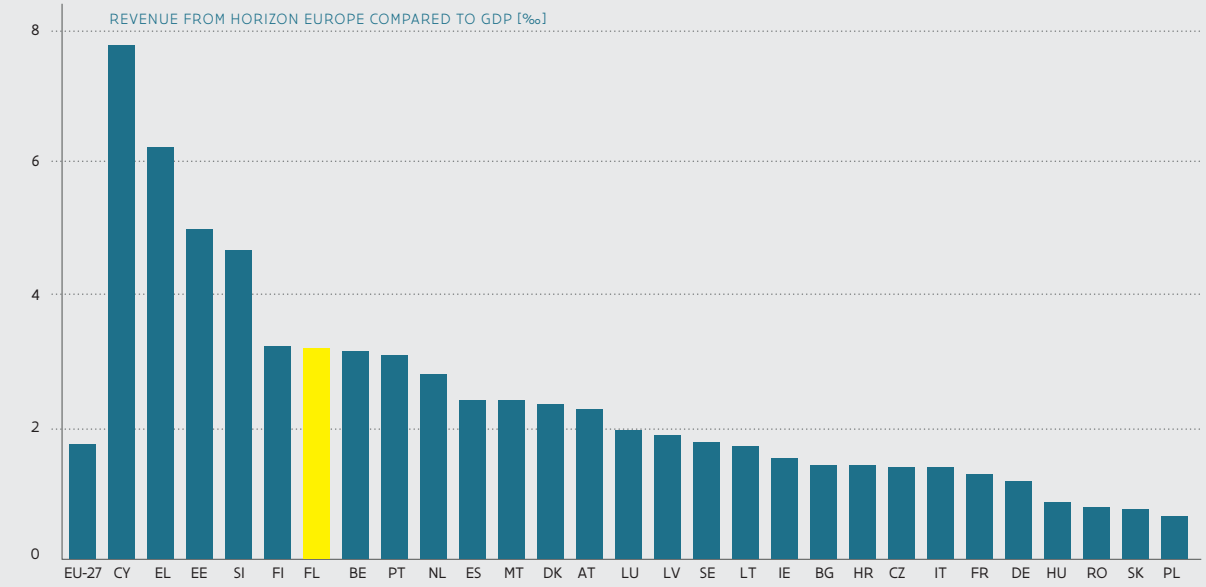
BENCHMARK FOR THE FLEMISH PARTICIPATION IN HORIZON EUROPE

Figure 29



HORIZON EUROPE AS PER INHABITANT

Figure 30



7.4 TOP PARTICIPATING ORGANISATIONS

The higher education sector (HES) is provisionally the main Flemish beneficiary of Horizon Europe, accounting for about 50.2% of the granted support received by Flanders. The research centers receive almost 25.8% of the support. Other public entities obtain a further 2.6% of the funding. Flemish private companies an non-profits account for the remaining 21.4%.

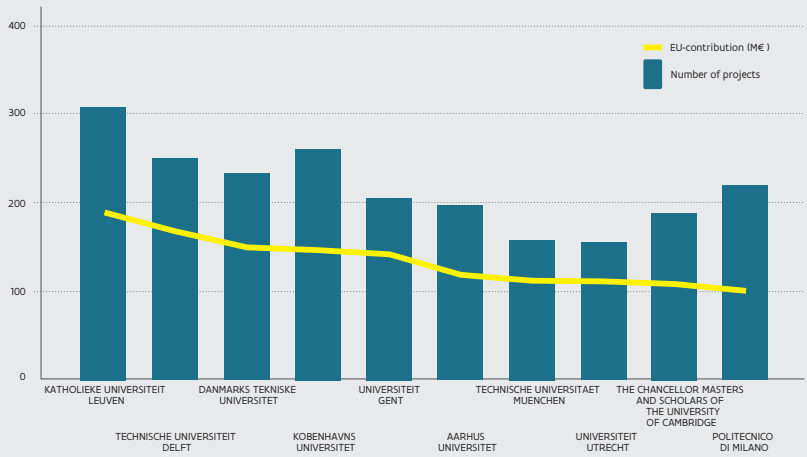
The top-3 participating institutions in Flanders in Horizon Europe are as of yet KULeuven, imec and UGent, which jointly represented 44.7% of the total EU FP contributions to Flemish grant holders.

Ranking all European Universities according to EU-contributions, the KU Leuven come out first and Ghent University as fifth for the entire EU.

The top ten of Flemish organizations is composed of four of the five Flemish Universities, five research organizations and one non-profit (Bio Base Europe Pilot Plant).

EUROPEAN TOP-10 UNIVERSITIES (HES) SORTED BY NUMBER OF PARTICIPATIONS AND FUNDING

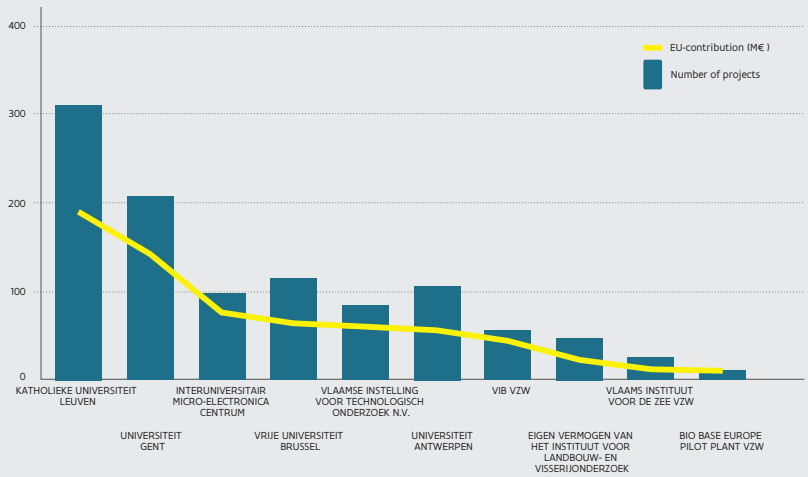
Figure 31



Source : Education department – DHO database

TOP-10 OF FLEMISH PARTICIPANTS IN HORIZON EUROPE ACCORDING TO NUMBER OF PROJECTS AND FUNDING (IN MILLIONS OF EUROS)

Figure 32



Source : Education department – DHO database

8

EU REGIONAL DEVELOPMENT FUND (ERDF) AND R&D&I SUPPORT

ERDF in Flanders is constructed around the following thematic objectives:

- TO1 《 Strengthening research, technological development and innovation》
- TO3 《 Enhancing the competitiveness of small and medium-sized enterprises (SMEs)》
- TO4 《 Supporting the shift towards a low-carbon economy in all sectors》
- TO5 《 Promoting climate change adaptation, risk prevention and management》
- TO6 《 Preserving and protecting the environment and promoting resource efficiency》

8.1 OBJECTIVES

The Flemish ERDF program 2021 – 2027 aims to strengthen the sustainable growth and competitiveness of Flanders, while at the same time accelerating the transition to a low-carbon, circular and energy-efficient economy. In this way, it contributes to a strong reduction in Flemish CO_2 emissions and the realization of the European Green Deal.

8.2 POLICY OBJECTIVES

The Flemish Operational program is developed around 2 axes (except technical assistance):

- **Axe 1**: a more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity.
- **Axe 2**: a greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility;

8.3 BUDGET

Table 9

PRIORITY AXE	SUPPORT OF THE EU	NATIONAL CONTRIBUTION	TOTAL FINANCING
AXE 1	160.045.353	192.189.094	352.234.447
AXE 2	106.696.903	128.126.063	234.822.966
TOTAL	266.742.257	320.315.157	587.057.413

More information on ERDF in Flanders :

- https://www.vlaio.be/nl/andere-doelgroepen/europees-fonds-voor-regionale-ontwikkeling
- https://www.vlaio.be/nl/media/446

ANNEX IV

HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY

1 INTRODUCTION

Highly educated and skilled personnel are a key resource for science and technology. Consequently, indicators for Human Resources in Science and Technology (HRST) are very important. HRST statistics always focus on two main aspects. Firstly, the stock of HRST that focuses on the characteristics of the current labour force involved in science and technology. Secondly, the flows showing the job-to-job mobility and the inflow from education to the science and technology labour force. In this case, particular attention is paid to scientists and engineers, who are often the innovators at the centre of technology-led development.

2 S&T STUDENTS

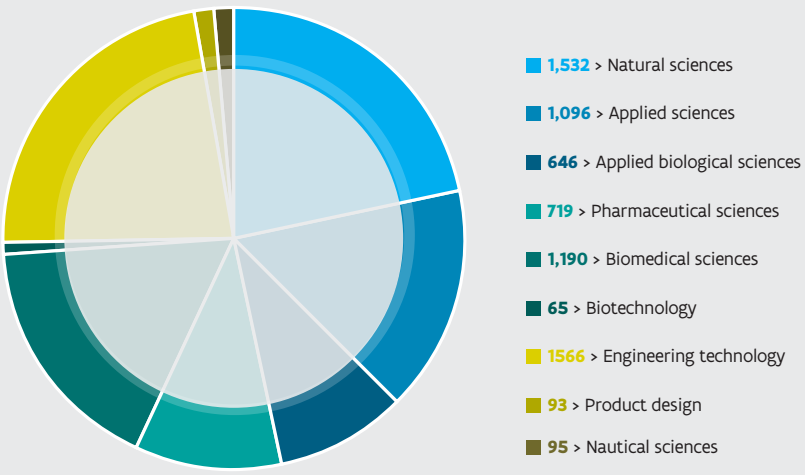
In the 2021-2022 academic year, 52.008 students enrolled for the first time at a Flemish university or a university of applied sciences and arts. Of this group, known as first entry students, more than half started a professional Bachelor training at a university of applied sciences and arts.

About 7,002 first entry students (about 30% of the total) at the universities start in the S&T domains (grouping together the natural sciences, applied sciences, applied biological sciences, pharmaceutical sciences, biomedical sciences, nautical sciences, industrial sciences and technology, biotechnology, and product design).

In the professional Bachelor at the universities of applied sciences and arts, more than 23% of first entry students opt for a study within the following science and technological domains: biotechnology and industrial sciences and technology.

THE NUMBER OF FIRST ENTRY STUDENTS AT FLEMISH UNIVERSITIES IN THE S&T DOMAIN FOR THE ACADEMIC YEAR 2021-2022, IN ABSOLUTE TERMS

Figure 33



Source : Education department – DHO database

3
S&T GRADUATES

In 2020-2021, 19.1% in the 20-29- year old population of Flanders had a higher degree in mathematics, science and technology. In this respect, Flanders ranks below the EU-27 average (20.9%) and the gap with the leaders (2020) - France (29.2%) and Finland (26.5%) - remains wide. On the other hand, Flanders scores better than the Netherlands, Norway, Italy and Sweden.

THE PROPORTION OF GRADUATES IN MATHEMATICS, SCIENCE AND TECHNOLOGY (HIGHER EDUCATION) IN FLANDERS PER 1000 FOR THE AGE GROUP 20 TO 29 YEARS (2016-2021)

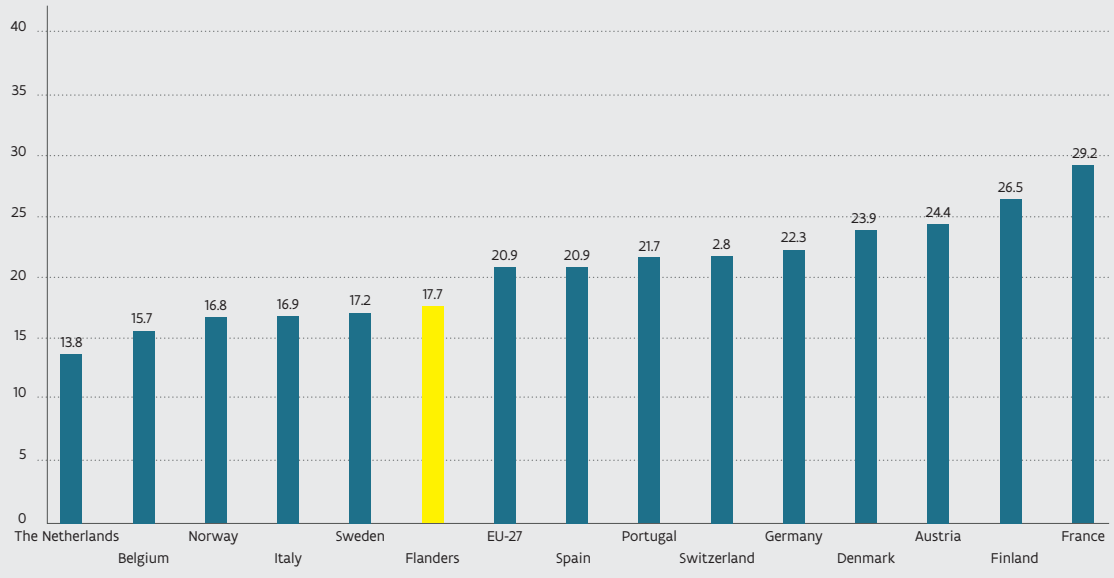
Table 10

ACADEMIC YEAR	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
FLANDERS	15.8%	15.6%	16.3%	16.4%	17.7%	19.1%

Flanders in 2020 = figure for Flemish Community academic year 2019-2020

INTERNATIONAL COMPARISON OF THE PROPORTION OF GRADUATES IN MATHEMATICS, SCIENCE AND TECHNOLOGY (HIGHER EDUCATION) PER 1000 FOR THE AGE GROUP 20 TO 29 YEARS (2020)

Figure 34



Source : Education department – DHO database, Ireland, United Kingdom: definition differs

The proportion of S&T graduates in the total number of graduates in Flanders decreased slightly between 2015 and 2019. Viewed from an international perspective, in 2020 Flanders was ranked rather low and well below the leaders (Germany, Finland, Sweden and EU-27 average), where more than 26% of all degrees are awarded in science, mathematics and technology. Only the Netherlands score poorly with regard to their proportional number of ST&M graduates.

EVOLUTION OF THE PERCENTAGE OF DEGREES IN MATHEMATICS, SCIENCE AND TECHNOLOGY IN HIGHER EDUCATION AS A PROPORTION OF ALL DEGREES IN HIGHER EDUCATION FOR FLANDERS (2017-2021)

Table 11

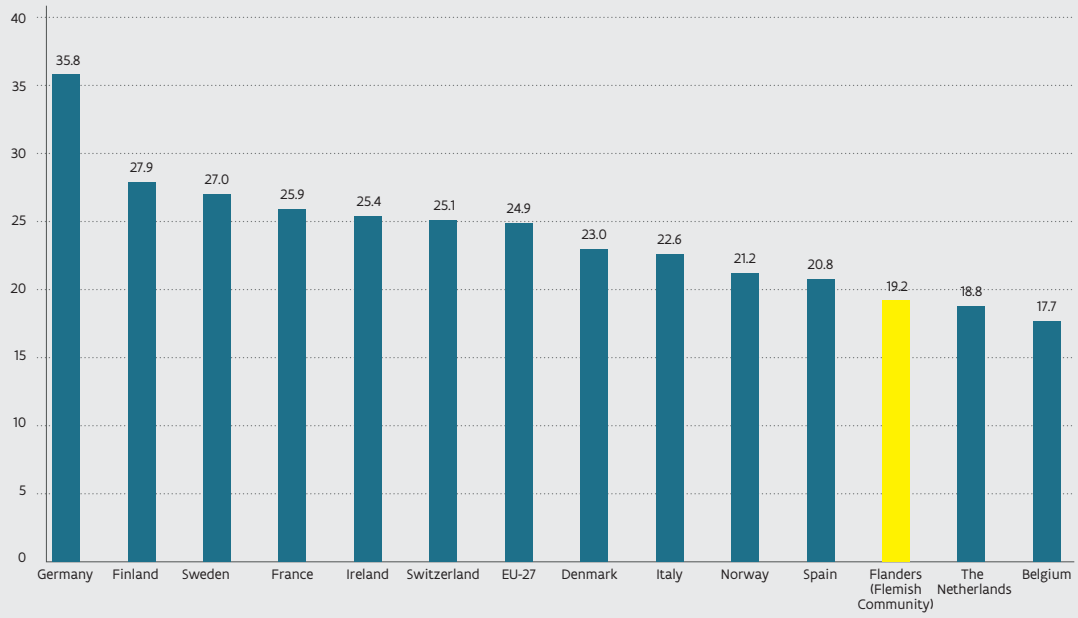
YEAR	2017	2018	2019	2020	2021
FLANDERS*	18.6%	19.2%	19.6%	19.2%	20.1%

Source : Education department – DHO database;
** Flanders: figures for Flemish Community 2020 = academic year 2019-2020*

Graduates higher education: ISCED 5: Short-cycle tertiary education, ISCED 6: Bachelor's or equivalent level, ISCED 7: Master's or equivalent level, ISCED 8: Doctoral or equivalent level.. The ISCED fields of education classification was reviewed in 2013 and the first implementation started for the academic year 2014-2015. Due to this methodological change , figures before 2015 cannot be compared.

INTERNATIONAL COMPARISON OF THE PERCENTAGE OF DEGREES IN MATHEMATICS, SCIENCE AND TECHNOLOGY IN HIGHER EDUCATION AS A PROPORTION OF ALL DEGREES IN HIGHER EDUCATION (2020)

Figure 35



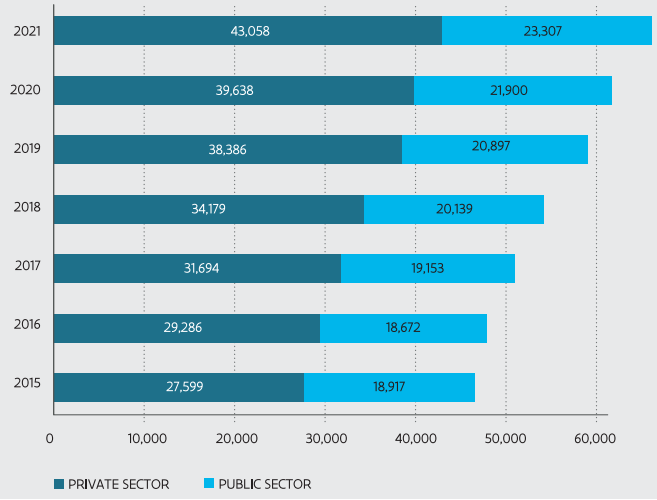
Source : Education department – DHO database; ⁎Flanders: figures for Flemish Community

4
R&D PERSONNEL

In 2021, the total number of R&D personnel for Flanders reached 66,365 full-time equivalents (FTE), which is an increase of 38.4% since 2016. Over the past five years, the number of research staff has increased both in companies and in the public sector. The public sector groups together all research institutes from the higher education sector (HES), the government sector (GOV) and the private not-for-profit sector (PNP). The majority of the R&D personnel (64.9%) work in the private sector (BES). The overall share of the public component (PNP, HES and GOV) declined between 2013 and 2019 and stays since 2020 rather stable. The HES component is the most important element of the public component (with 16,908 FTE or 72.5%) in 2021, followed by the GOV component (5,946 FTE or 25.5%).

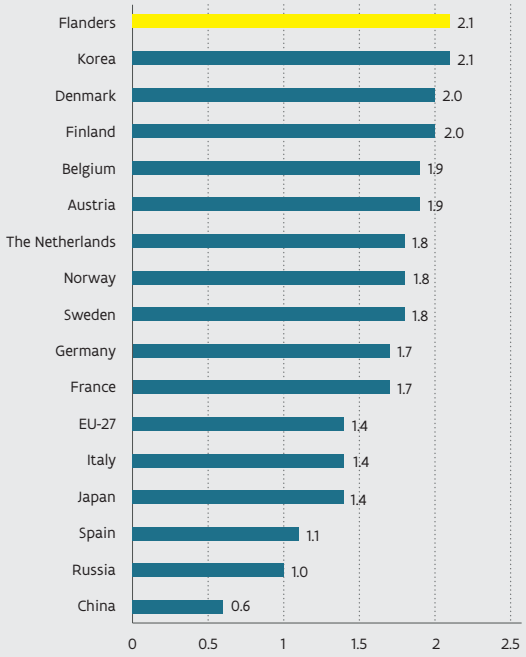
EVOLUTION OF THE R&D PERSONNEL FROM 2015 TO 2021

Figure 36



INTERNATIONAL POSITION OF FLANDERS FOR TOTAL R&D PERSONNEL (% OF THE LABOUR FORCE) IN 2021

Figure 37



Source: OECD database. Main Science and Technology Indicators
Spain, Italy, EU27, Japan, Austria, Belgium, the Netherlands, France, Germany, Norway, Sweden, Finland and Denmark: estimation Japan, Austria and Spain: other definition Denmark, Norway, the Netherlands and Germany : provisional figure figure for China (2018) , Italy (2019) and Belgium (2020)

The level of R&D personnel corresponds to 1.0% of the total population and 2.12% (2021) of the labour force. Flanders therefore belongs to the top with regard to R&D personnel numbers as a proportion of the labour force. Finland, Denmark and Korea also show high figures but Flanders still ranks a little higher. The Flemish figure is much higher than the EU27 average.

The R&D staff with the companies (private sector) counted about 38,950 full-time equivalents in 2021 and this figure corresponds with about 61,050 headcount, of which more than 32,300 researchers and approximately 28,750 technical and other personnel.

The R&D staff within the non-profit organisations (public sector) counted more than 23,300 full-time equivalents in 2021. This figure corresponds with about 38,400 headcount, of which more than 27,850 researchers and approximately 10,550 technical and other personnel. The breakdown of R&D staff by gender shows that around 18,200 women and 20,200 men are employed in the public sector on R&D activities. About one in three of the R&D personnel in the public sector has granted a PhD (12,000 headcount).

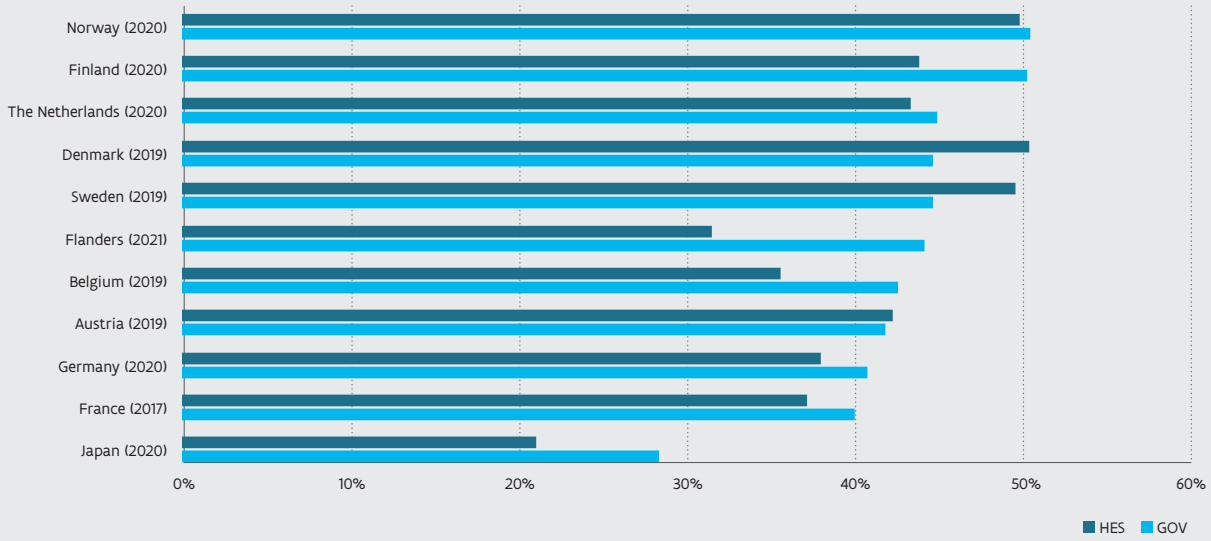
The R&D personnel in the GOV and HES (2021) can be broken down by different fields of science. For the GOV sector, this indicates the dominant position of engineering and technology. For the HES sector, the most important fields of science are the medical sciences, engineering, the natural sciences and social sciences.

About 82% of the R&D personnel working in the HES on R&D activities in Flanders are researchers (2021). This figure is high compared to the other European countries and much higher than the EU-27 average but lower than Sweden. Approximately 73% of the R&D personnel (2021) in the GOV in Flanders are also researchers. Once again, this figure is higher than for France, Germany and the EU-27 average, but this time lower than Denmark and Finland.

With a figure of 44.1% for female researchers working in the higher education (HES), Flanders again compares favourably with neighbouring countries (Germany and France), but the Scandinavian countries show similar or higher rates here. For female staff working in public research centres (GOV), Flanders has a score lower than the neighbouring countries, but once again cannot match the higher performance of the north European countries.

INTERNATIONAL COMPARISON - % SHARE OF WOMEN RESEARCHERS IN GOV AND HES (HEADCOUNT) IN 2021

Figure 38



Source: OECD database. Main Science and Technology Indicators
Austria, Japan, Germany (GOV) and the Netherlands (GOV): other definition; Sweden: break in time series; Denmark and France: provisional figure.

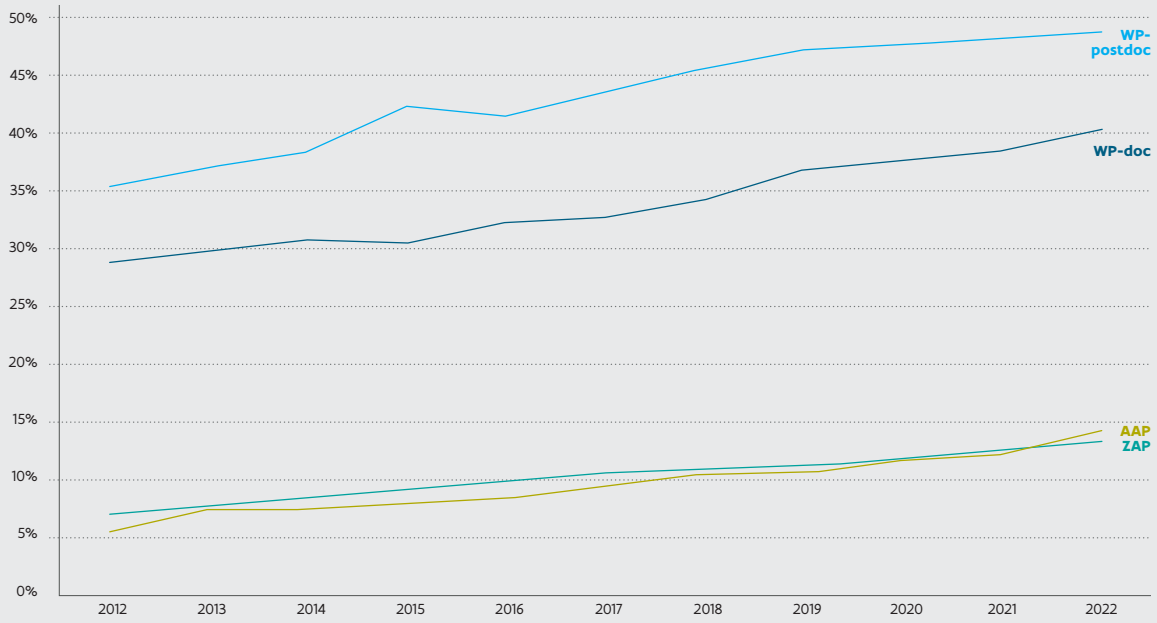
5 MOBILITY OF RESEARCHERS

Between 2004 and 2022, the existing pattern of nationality for all statutes and levels of academic careers in Belgium gradually changed. These changes were least pronounced for Assisting Academic Staff or AAP (in 2004. 95.6% were Belgians and 85.3% in 2022) and for Senior Academic Staff or ZAP (95.0% in 2004 and still 86.1% in 2022). However, the changes were particularly strong for Scientific Staff or WP, above all in the sub-category "post-doctorates", where the number of Belgian researchers declined from 77.2% in 2004 to 51.2% in 2022. The same trend is also noticeable for doctoral researchers: from 88.3% in 2004 to 59.6% in 2022.

Dutch, Italian and Chinese researchers are strongly represented among the group of foreign researchers in Belgium but also researchers from Germany, India and Iran are quite good represented. Foreign researchers are mainly found in the doctoral and postdoctoral sub-categories. The share of non-EU researchers for ZAP (Senior Academic Staff) or AAP (Assisting Academic Staff) personnel is rather limited from 2.1% to 5.5% of the total.

EVOLUTION OF THE NON-BELGIAN NATIONALITY OF RESEARCHERS FOR THE DIFFERENT STATUTES AND LEVELS OF THE ACADEMIC CAREER (2012-2022)

Figure 39



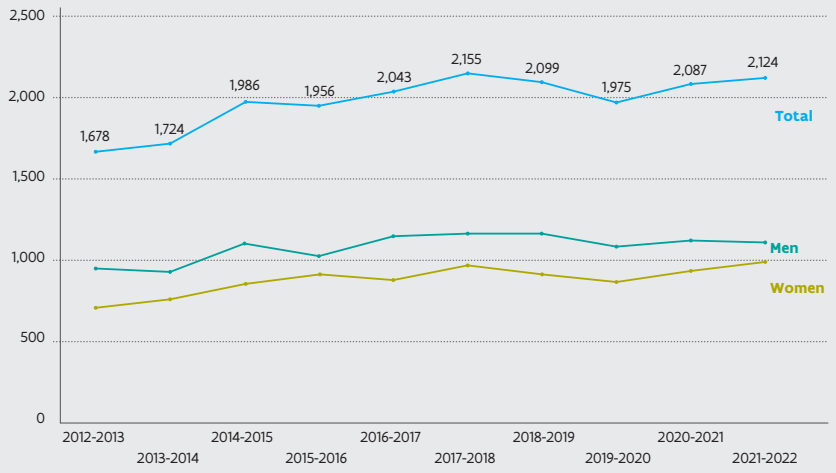
Source: VLIR

The Human Resources in Research Flanders (HRRF) database indicates that 80.4% of the researchers who obtained a PhD in the academic years 2011-2012 to 2013-2014 were no longer active in a post-doc or ZAP function at a Flemish university, three years after getting their PhD. The largest part of these will most likely be employed by the non-academic labour market in Flanders. But a relevant part of these will be continuing an academic career outside Flanders. Unfortunately no reliable information is available on the size of each of these groups. A study some years ago showed the most popular destinations for Belgian PhD holders to continue their career. Most of them went to the United States due to the availability of positions at renowned research institutes. Belgian researchers also frequently choose neighbouring countries with strong research tradition, such as France, the United Kingdom, the Netherlands and Germany. This mobility pattern was similar to other Western European countries.

After a steady increase until 2017-2018, the total number of PhDs in Flanders had decreased, reaching a level of 1,975 new doctorate holders in 2019-2020. The number of female PhDs has also grown significantly more than the number of male PhDs. Even so, the proportion of women holders is increased to 45%. An analysis of the number of PhDs per field of science shows a substantial increase for engineering & technology and the social sciences. The medical sciences (21.5%), engineering & technology (20.5%) and the social sciences (19.8%) have the largest share in the total number of PhDs by field of science

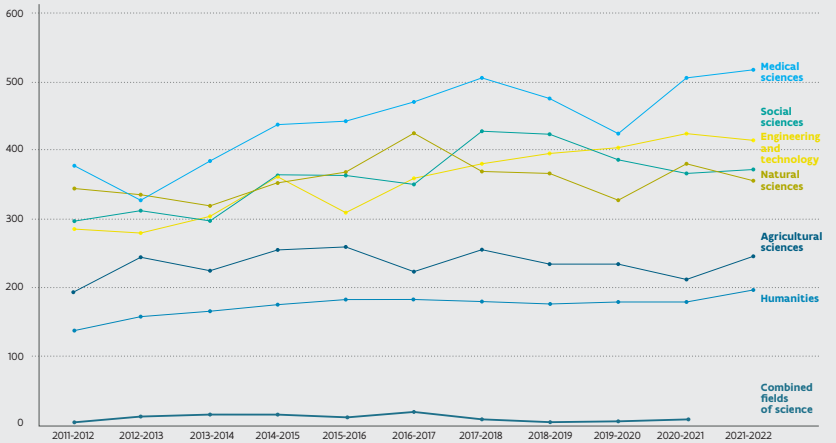
EVOLUTION OF THE NUMBER OF PHDS IN FLANDERS BY GENDER FROM 2012-2013 TO 2021-2022

Figure 40



EVOLUTION OF THE NUMBER OF PHDS IN FLANDERS BY FIELD OF SCIENCE FROM 2011-2012 TO 2021-2022

Figure 41



ANNEX V

INNOVATION EFFORTS BY ENTERPRISES IN FLANDERS

(CIS RESULTS)

1

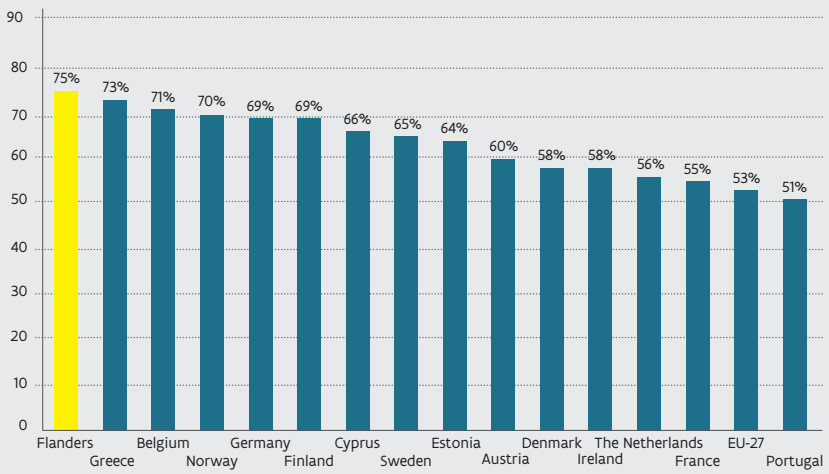
CIS: GLOBAL RESULTS

Based on the principles described in the Oslo Manual, the innovation efforts made by business enterprises in the European Union are systematically measured by the Community Innovation Survey (CIS). These harmonized surveys are carried out by the national statistical offices and are designed to give information about the degree of innovativeness in different sectors and regions. In 2018 the Oslo Manual was revised. A major consequence of this revision was that the three concepts of (technological) process innovation, organisational innovation and marketing innovation that before 2018 were considered separately, were now combined into one overall concept of business process innovation. This move was motivated by the fact that the three processes oftentimes overlap and co-occur. Hence, after the 2018 revision of the Oslo Manual, we are left with two broader types of innovation to consider: product innovation, and the more broadly defined business process innovation.

The overall innovation rate (including product innovation, business process innovation as well as ongoing or abandoned innovation activities) of Flanders rose from 56% in 2010-2012 to 75% in 2018-2020. In 2020, Flanders scored well above the EU-27 average (53%) and is ranked among the top countries Greece (73%), Norway (70%), Germany and Finland (both 69%).

INTERNATIONAL COMPARISON OF THE PERCENTAGE OF COMPANIES WITH PRODUCT INNOVATIONS,BUSINESS PROCESS INNOVATIONS AND/OR ONGOING OR ABANDONED INNOVATION ACTIVITIES (2018-2020 (CIS 2021))

Figure 42




© Luc Daelemans

2

TOTAL INNOVATION OVER TIME

Following the revision of the Oslo Manual, we look at the overall innovation rate in Flanders over time. The total innovation rate now includes product innovation, the more broadly defined business process innovation (which also includes non-technological aspects such as organisational and marketing innovation, besides purely technological process innovations) as well as ongoing and abandoned innovation activities. The results for CIS 2021 show that in the period 2018-2020 75% of the business enterprises in Flanders were innovative and had either product innovations, business process innovations and/or ongoing or abandoned innovation activities. These results are a slight increase to those obtained with CIS 2015 and 2017 (both 68%) and CIS 2019 (70%), for the periods 2012-2014, 2014-2016 and 2016-2018, respectively.

EVOLUTION OF THE PERCENTAGE OF BUSINESS ENTERPRISES IN FLANDERS WITH PRODUCT INNOVATIONS, BUSINESS PROCESS INNOVATIONS AND/OR ONGOING OR ABANDONED INNOVATION ACTIVITIES

Table 12

	CIS2009 2006- 2008	CIS2011 2008-2010	CIS2013 (2010-2012)	CIS2015 2012-2014	CIS2017 2014-2016	CIS2019 2016-2018	CIS2021 2018-2020
TOTAL INNOVATION ACTIVITIES	61%	61%	56%	68%	68%	70%	75%
SMEs	61%	60%	56%	68%	68%	69%	74%
LARGE COMPANIES	85%	85%	80%	87%	88%	90%	93%
LOW TECHNOLOGY	58%	58%	53%	66%	65%	67%	71%
HIGH TECHNOLOGY	78%	79%	71%	78%	83%	83%	89%
INDUSTRY	64%	69%	62%	75%	76%	76%	80%
SERVICES	60%	55%	452%	63%	63%	66%	71%

Source: ECOOM

Large companies and medium-sized companies generally are more innovative than smaller firms. The most innovative firms are high tech firms and manufacturing firms.

Firms report that regulations may have some negative impact on innovations, but for environmental, intellectual property and tax regulations medium and large size firms also report a positive impact of those regulations, as they facilitate or help initiate innovations.

Collaboration in innovation activities remains very important. Suppliers, consultants, commercial laboratories or research institutions and other companies within the group are the most important partners. For large firms, public research institutes or the government are also important partners for their innovation activities.

3

PRODUCT INNOVATION AND BUSINESS PROCESS INNOVATION

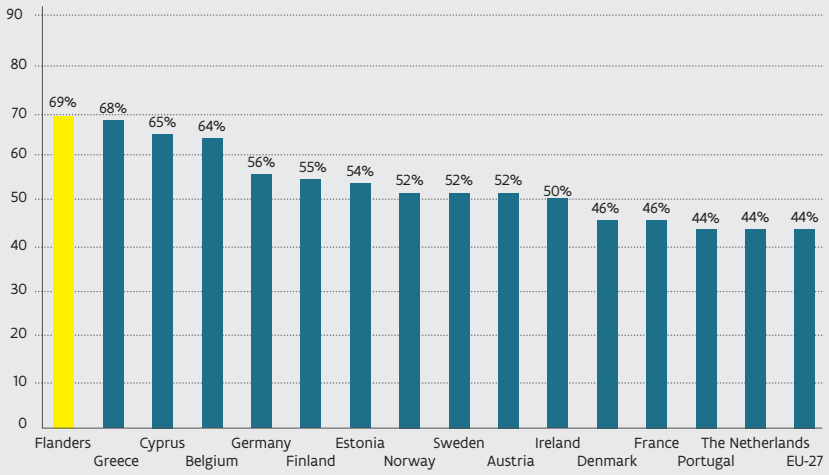
Business process innovation is a very important way of innovation in Flemish companies. Approximately 69% of all enterprises carried out business process innovation and this corresponds to 92 of all Flemish innovative companies. Approximately 37% of all enterprises carried out product innovation in the period 2018-2020, corresponding to 49% of all Flemish innovative companies. Approximately 35% of all enterprises report ongoing innovation activities and 13% report abandoned innovation activities in the period 2018-2020 (corresponding to, respectively, 46% and 17% of all innovative enterprises in Flanders).

With an innovation rate for business process innovation of 69% in 2018-2020, Flanders is one of the leading countries in comparison with the rest of Europe and the EU-27 figure.

With an innovation rate for product innovation of 37% in 2018-2020, Flanders scores higher than the figure for the EU-27 but lower than the leading countries for this indicator (Greece and Norway).

INTERNATIONAL COMPARISON OF THE PERCENTAGE OF BUSINESS ENTERPRISES WITH BUSINESS PROCESS INNOVATION (2018-2020 (CIS 2021))

Figure 43



ANNEX VI

STI PRODUCTIVITY OR STI OUTPUT?

1

INTRODUCTION

Patent statistics and publication statistics provide important indicators for measuring R&D output. Long time series are available and the data allow cross-country comparison. This section looks more closely at the role of publications and patents (applications and grants) as an output of R&D expenditure. (Source of all output publication and patent data : ECOOM)

2

SCIENTIFIC PUBLICATIONS

Scientific publications are an important instrument for measuring the visibility of research output. This analysis is based on the major bibliographic information of ISI-Thomson Scientific; namely, the Science Citation Index (scientific journals) and the Proceeding Database (conference proceedings). The Flemish output of scientific publications has increased significantly in recent years. In 2021, there were 37.3 publications per 10,000 inhabitants, whereas there were only 27.0 publications per 10,000 inhabitants in 2014. Flanders still ranks in the fourth position in Europe after Denmark, Sweden and Finland.

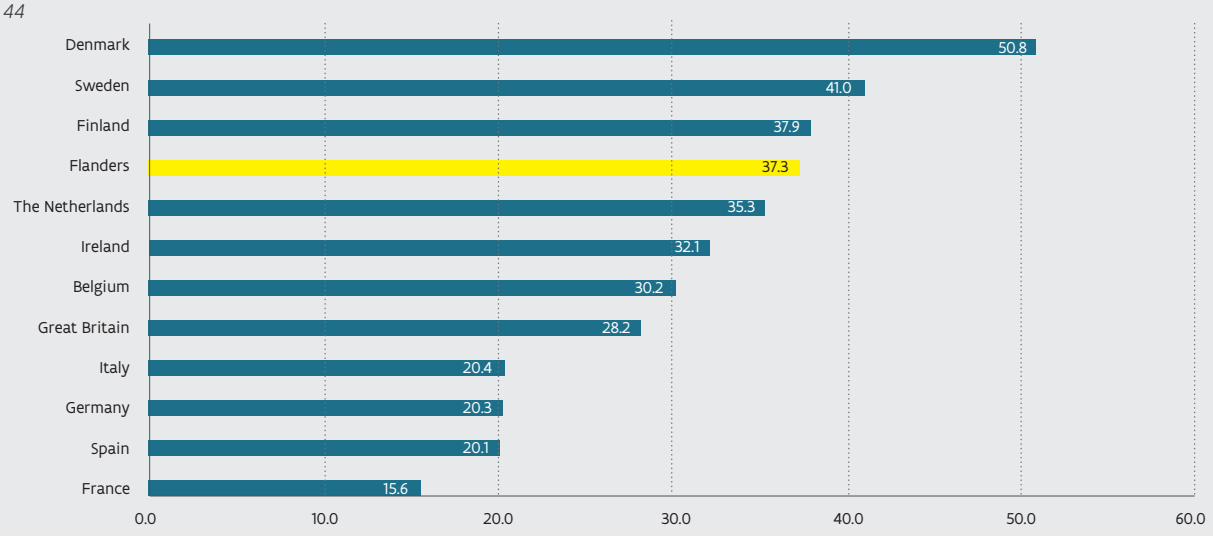
EVOLUTION OF THE PUBLICATION OUTPUT PER 10,000 INHABITANTS FOR FLANDERS (2014-2021)

Table 13

	2014	2015	2016	2017	2018	2019	2020	2021
ONLY SCIENTIFIC JOURNALS	24.5	25.5	25.7	27.7	29.5	30.5	29.6	34.1
SCIENTIFIC JOURNALS AND PROCEEDINGS	27.0	28.7	30.6	32.4	32.7	33.3	32.5	37.3

INTERNATIONAL COMPARISON OF THE PUBLICATION OUTPUT PER 10,000 INHABITANTS (2021)

Figure 44



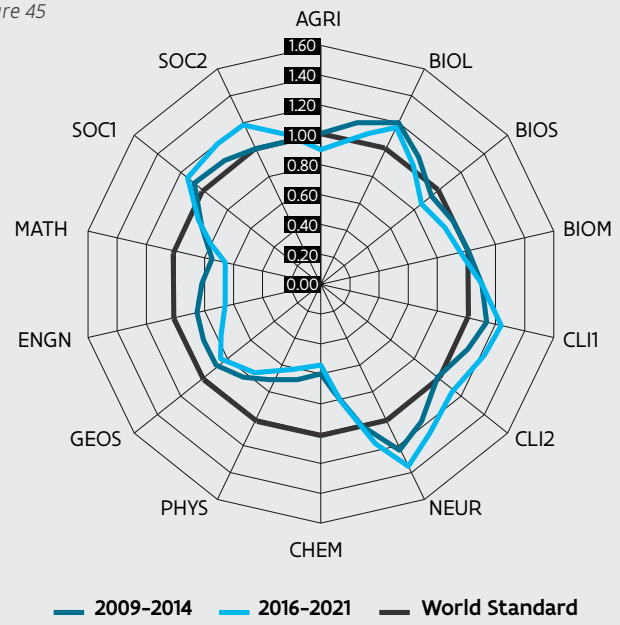
The contribution of Flanders in the total number of publications for Belgium showed since 2000 an upward trend and now fluctuates about 73% for the most recent years (2016-2021). The Flemish contribution (journal articles only, all S&T fields) of the world total of scientific publications had fluctuated around 1.0% with a highest share of 1.05% in 2015. In the past ten years, the share for most European countries and the UK in the global amount of publications started to decline and while the share for Italy showed a small increase. These evolutions should be seen in relation to the strong growth of China's research output and share. In 2002, China's share of world publication output was roughly equivalent to that of Italy (about 5%). China passed France in 2004, Germany in 2005 and Great Britain in 2006. By 2020, the Chinese share had already risen to 25%.

All publication output for the period 2016 to 2021 can be broken down into publications by different types of organisations. The share of higher education (universities and universities of applied sciences and arts) in the total number of Flemish scientific publications amounted to more than 88%. About 14% of all Flemish SCIE documents was published by employees from public research institutes or civil servants. Private institutions (both profit and non-profit) and hospitals (apart from university hospitals) were responsible respectively for almost 6% and about 5% of the total. The share of the higher education has continued to increase slightly in recent years.

The scientific specialisation profile for Flanders for the period 2009 to 2021 is a typical example of the classic "Western" pattern, with life sciences and medical sciences as the dominant publication areas. Nevertheless, some other evolutions within his overall pattern are worth noting. For example, there was a sharp growth in Flanders between 2016 and 2021 in the fields of neuroscience (NEUR) and the social sciences (SOC1 and SOC2). The Flemish publication profile also shows that its output is significantly above the world standard in terms of biology (BIOL), biomedical research (BIOM), life sciences (BIOS), clinical and experimental medicine I (CLI1) and neuroscience (NEUR). In contrast to these fields related bio and life sciences, the STEM related fields show a share below the world standard: chemistry (CHEM), physics (PHYS), earth and spaces sciences (GEOS), and also for mathematics (MATH) and engineering (ENGN). It is important to point out here that the share per field is a balanced indicator meaning that an increase of the share in one field is compensated by a decrease in another unrelated field.

THE SCIENTIFIC PUBLICATION PROFILE OF FLANDERS IN 2009-2014 AND 2016-2021 BASED ON THE ACTIVITY INDEX (AI)

Figure 45



AGRI = Agronomy and Environmental Sciences

BIOL = Biology (at the organism and the supra-organism level)

BIOS = Life Sciences (general, cellular and subcellular biology, genetics)

BIOM = Biomedical Research

CLI1 = Clinical and Experimental Medicine (general and internal medicine)

CLI2 = Experimental Medicine II (non-internal)

NEUROS = Neurosciences

CHEM = Chemistry

PHYS = Physics

GEOS = Earth and Space Sciences

ENGN = Engineering

MATH = Mathematics

SOC1 = Social sciences 1 (general, regional & community issues)

SOC2 = Social sciences 2 (economic, political and legal sciences)

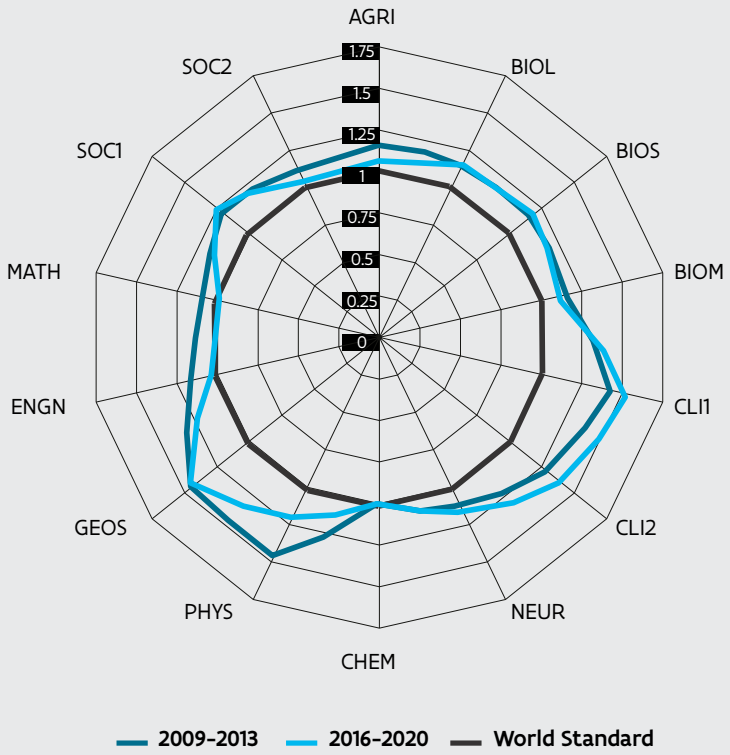
3 CITATIONS

Citations analysis reflects the visibility of or impact made by the research output of the scientific community and can also be used as a proxy for measuring the quality of that output. Compared to other European countries and based on the results for the different periods covered in the citation map (2009-2013 and 2016-2020), Flanders is part of the leading group with Sweden, Denmark, Ireland and the Netherlands. Flanders is closing the gap with the leading countries: Denmark and the Netherlands.

The results of the two periods show that, in terms of relative citation frequency, Flanders is above or at least equal to the world standard in all fields of science. In particular, a very high score can be noted for the life sciences. The indicator values for chemistry (CHEM) and mathematics (MATH) are the lowest, but still almost represents the neutral value of 1.0 in comparison with the world standard. The relative citation scores for clinical research (CLI1 and CLI2) are higher than for the natural sciences. Also noteworthy is the increased impact in clinical research (CLI1 and CLI2) and earth and space sciences (GEOS) and the decreased impact in agriculture (AGRI), engineering (ENGN) and mathematics (MATH).

THE SCIENTIFIC CITATION PROFILE OF FLANDERS FROM 2009-2014 AND 2016-2021 BASED ON THE ACTIVITY INDEX (AI)

Figure 46



AGRI = Agronomy and Environmental Sciences

BIOL = Biology (at the organism and the supra-organism level)

BIOS = Life Sciences (general, cellular and subcellular biology, genetics)

BIOM = Biomedical Research

CLI1 = Clinical and Experimental Medicine (general and internal medicine)

CLI2 = Experimental Medicine II (non-internal)

NEUROS = Neurosciences

CHEM = Chemistry

PHYS = Physics

GEOS = Earth and Space Sciences

ENGN = Engineering

MATH = Mathematics

SOC1 = Social sciences 1 (general, regional & community issues)

SOC2 = Social sciences 2 (economic, political and legal sciences)

4
CO-PUBLICATIONS

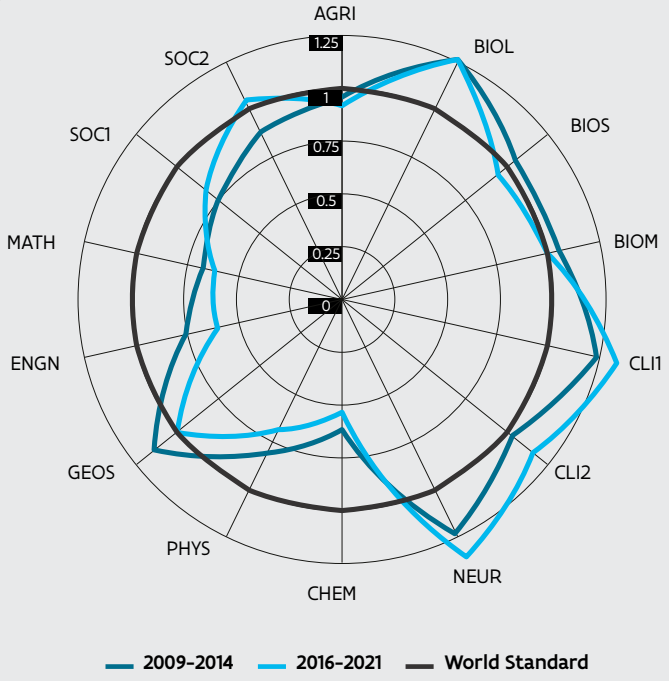
Flemish scientific publications are increasingly the result of close international cooperation. In 2021, almost 73.4% of the publications were written with at least one foreign co-author. Flanders occupies a leading position with Sweden (71.5%), Denmark (71.1%) and Finland (69.9%) in the ranking of countries involved in co-authorship (2021). An analysis of the major co-publication links for Flanders for the period 2016-2021 reveal strong cooperation links with the Netherlands, Germany, UK, France, Spain and Italy. Other (but weaker) co-publication links can be found for most of the other EU-26 countries (Portugal, Ireland, Sweden, Finland, Estonia, Latvia, Lithuania, the Czech Republic, Austria, Bulgaria, Greece, Switzerland, Denmark, Hungary), the USA, Belarus, Georgia, Switzerland.

The relatively important link with some African countries (for example, the Democratic Republic of Congo) can partly be explained on historical grounds, but also other important cooperation with Africa and Asia can be noticed.

A comparison between the profile of the international co-publications of Flanders with the profile of all publications shows a clear polarisation in favour of the biosciences (BIOL and BIOS), of biology (BIOL), the neurosciences (NEUR) and the the earth and space sciences (GEOS) and physics (PHYS) to the detriment of the social sciences (SOC1/2). In the second period (2014-2019), the profile for Flanders for co-publications moved significantly over the world standard in the neuro- and behavioural sciences (NEUR), the Clinical and Experimental Medicine (general and internal medicine) (CLI1), the social sciences 2 (economic, political en legal sciences) (SOC2). On the other hand, the co-publication activity in chemistry, physics, engineering and mathematics decreased and the co-publication activity in the social sciences increased.

THE SCIENTIFIC CO-PUBLICATION PROFILE OF FLANDERS FROM 2005-2010 AND 2014-2019 BASED ON THE ACTIVITY INDEX (AI)

Figure 47



AGRI = Agronomy and Environmental Sciences

BIOL = Biology (at the organism and the supra-organism level)

BIOS = Life Sciences (general, cellular and subcellular biology, genetics)

BIOM = Biomedical Research

CLI1 = Clinical and Experimental Medicine (general and internal medicine)

CLI2 = Experimental Medicine II (non-internal)

NEUROS = Neurosciences

CHEM = Chemistry

PHYS = Physics

GEOS = Earth and Space Sciences

ENGN = Engineering

MATH = Mathematics

SOC1 = Social sciences 1 (general, regional & community issues)

SOC2 = Social sciences 2 (economic, political and legal sciences)

5

SOCIAL SCIENCES & HUMANITIES

The growing importance of publications in the innovation chain and in the distribution of research funds to universities has become evident in recent years. Studies also show that the Web of Science (WoS) does not fully represent the research efforts being made in the social sciences and the humanities. The Flemish Government also wants to map the publications that are not included in the WoS. Consequently, a group of experts was charged to collect both groups in a database, called the "Vlaams Academisch Bibliografisch bestand" (VABB) for the socio-economic sciences and humanities (SSH).

At the present time, VABB-SSH lists 140,795 publications published between 2000 and 2021, of which just 65,239 were found in the WoS (under the categorisations SCIE, SSCI, AHCI and the proceedings for CPCI-S & CPCI-SSH). The other 75,556 contained 43,019 articles in journals, 2,207 books (author), 3,556 books (editor), 23,493 chapters in books and 3,281 proceedings. Analysed by discipline, social health sciences has the greatest share (15.9%), followed by law (14.8%), economics and business (14.5%), and psychology (11.2%).

6

PATENTS

Patents are intended to grant innovators a temporary monopoly to exploit their innovative efforts. Patent information also helps to map technological progress and assess the degree of innovation within a particular organisation or region. The total number of patents for Flanders, as well as for the other reference countries, has increased in recent years.

Between 1980 and 2021, 62,467 EPO patent applications with a Belgian inventor and/or applicant were made and, at the moment when the analysis was made, 34,013 or 54% had been effectively assigned. For Flanders, 42,863 patents applications were filed during the same period and 23,472 (55%) were assigned. These proportions are roughly equal to those for the following reference countries: Finland and Denmark (56%), the Netherlands (57%) and Denmark (57%) and Italy (58%). Germany and Japan (63%), France and Austria (62%) have the highest assignment rates.

An international comparison (2018) of the number of patents by origin (EPO applications) indicates that Flanders is located in the group of followers (ninth position), with 288.6 patents per million of population, (origin based on inventor and/or applicant address). This ranking is led by Switzerland, Luxembourg[26], Sweden and Finland. Flanders is ranked after Austria (eighth) and before Belgium (tenth). From an international perspective, this is quite a good result for Flanders and Belgium, bearing in mind that all the reference countries together represent about 95% of total patent activities.

26 It should be noted that Luxembourg is characterised by a population of less than 0.5 million inhabitants. The indicator patents / million inhabitants hence implies a multiplication of the absolute volumes with a factor approximating 2, which is not the case for any of the other reference countries. In absolute terms therefore, the numbers for Luxembourg are lower than what the figure suggests.

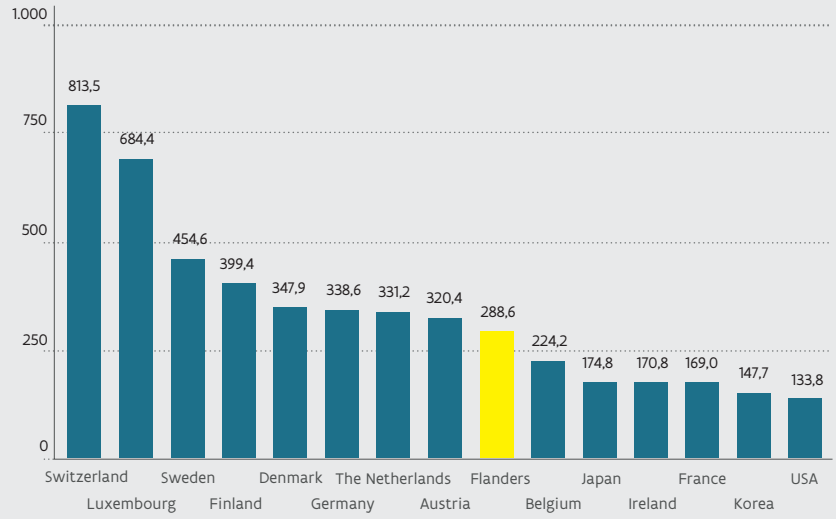
EVOLUTION OF EPO PATENT APPLICATIONS FOR FLANDERS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2010-2019)

Table 14

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
FLANDERS	243,4	253,1	254,3	247,5	270,6	276,9	275	270	288,6	258,2

INTERNATIONAL COMPARISON OF EPO PATENT APPLICATIONS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2018)

Figure 48



Based on patents granted under the USPTO system, Belgium and Flanders occupy respectively the fifteenth and the thirteenth place. The leaders here are Switzerland, USA and Luxembourg.

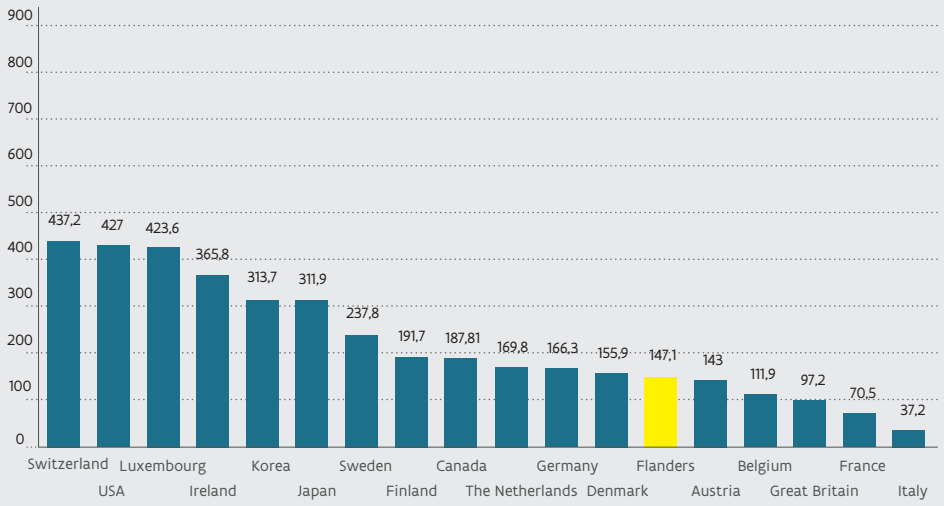
EVOLUTION OF USPTO PATENT GRANTS FOR FLANDERS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2010-2019)

Table 15

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
FLANDERS	161,1	167,9	179,9	195,6	215,8	217,6	227,5	200,6	147,1	99,1

INTERNATIONAL COMPARISON OF USPTO PATENT GRANTS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2018)

Table 49



Flanders occupies the eleventh place in the ranking of PCT applications, with Belgium in fourteenth position. This list is headed by Luxembourg, Switzerland, Sweden, Finland and Japan.

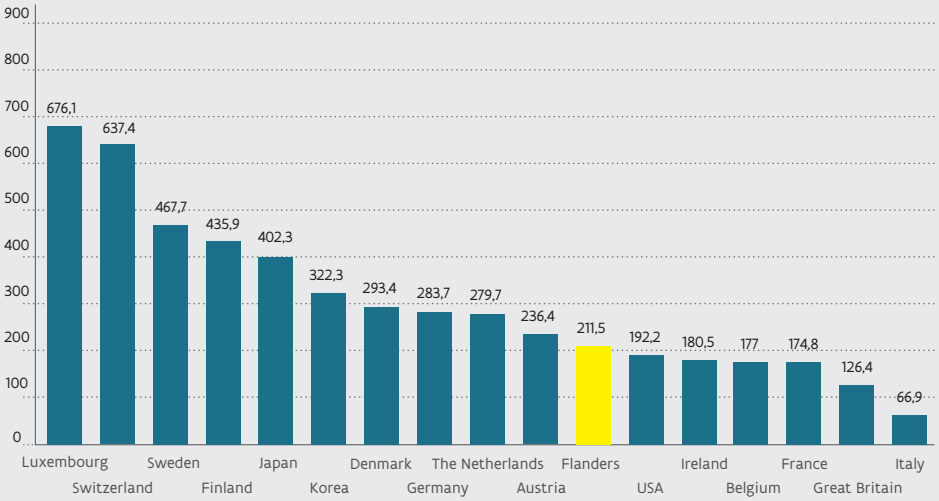
EVOLUTION OF PCT PATENT APPLICATIONS FOR FLANDERS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2010-2019)

Table 16

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
FLANDERS	189,9	194,3	199,5	209,4	187	208	205,5	201	206,2	211,5	199,8

INTERNATIONAL COMPARISON OF PCT PATENT APPLICATIONS PER MILLION OF POPULATION BY ORIGIN, INVENTOR AND/OR APPLICANT (2018)

Figure 50



A breakdown in organisational types reveals that companies are particularly active in applying for patents (82% of patents are held by companies). The most important applicants (companies) for Flanders are Agfa-Gevaert, Janssen Pharmaceutica, CNH (Case New Holland) Belgium). Universities (including scientific research centres like IMEC, VIB,...) are increasingly active as patent applicants (owning almost 11% of patents). An international comparison shows that this 11% rate is very high.

In 30% of all EPO-patent applications with a Flemish inventor, foreign applicants are involved (measured over the last ten years). It concerns mainly applicants from the United States (17%), France and Germany (with respectively 8% and 7%). International inventor collaboration can further be illustrated by considering patents with at least one Flemish inventor and one foreign inventor (international co-inventions). This is the case for 41% of Flemish patents. International co-applicants (at least one Flemish applicant and at least one foreign applicant) represent 50% of all Flemish patents.

A regional European patent map divided 288 European regions at the NUTS2 (NUTS2016 version) level. The European top-five (based on applicants addresses) are: Nordwestschweiz (CH), Noord-Brabant (NL), Oberbayern (DE), Inner London – West (UK), and Zentralschweiz (CH). For Flanders, Vlaams-Brabant occupies position 37 in this ranking, with West-Vlaanderen at 44, Oost-Vlaanderen at 65, Antwerpen at 69 and Limburg at 87. When considering inventor addresses, the top-five are Voralberg (AT), Noord-Brabant (NL), Nordwestschweiz (CH), Mittelfranken (DE) and Oberbayern (DE). The Flemish provinces are ranked at 22 (Vlaams-Brabant), at 53 (Oost-Vlaanderen), at 60 (Antwerpen), at 70 (West-Vlaanderen) and at 107 (Limburg).

The regional patent map for Flanders allocates patents to the departmental level. Based on inventor addresses, the top-five are Leuven, Gent, Diksmuide, Kortrijk, and Halle-Vilvoorde and Kortrijk. For applicant addresses, the top-five is composed of Leuven, Brugge, Gent, Kortrijk, and Dendermonde.

© Shutterstock

ACRONYMS AND ABBREVIATIONS

AAL	Active and Assisted Living
AAP	Assisting Academic Staff
AAVREU	General Representation of the Government of Flanders to the EU
ADMA-Energy	Advanced Manufacturing for Energy-Related Applications
AHA	Active and Healthy Aging
AMCER	Advanced Monitoring and Coordination of R&D policies at European level
AMR	Antimicrobial Resistance
ANAEE	Analysis and Experimentation on Ecosystems
ARWU	Academic Ranking of World Universities
AO	Enterprise Flanders
BAN Vlaanderen	Business Angels Network in Flanders
BBEU	Bio-Base Europe
BBI	BioBased Industries
BBRI	Belgian Building Research Institute
BCRC	Belgian Ceramic Research Centre
BELSPO	Programmatory Public Service for Science Policy
BERD	Business Expenditure on Research and Development
BES	Business Enterprise Sector
BIRA	Belgian Institute for Space Aeronomy
BOF	Special Research Fund
BRRC	Belgian Road Research Centre
BWI	Belgian Welding Institute
CECAM	European Centre for Atomistic and Molecular Computations
Centexbel	Scientific and Technical Service Centre for the Belgian Textile Industry

CEO	Chief Executive Officer
CERN	European Organisation for Nuclear Research
CERN-CMS	European Organisation for Nuclear Research - Compact Muon Solenoid
CIS	Community Innovation Survey
COOCK	Collective Research and Development and Collective Knowledge Dissemination
CORI	Coatings Research Institute
COST	(European) Cooperation in Science and Technology
CRC	Antwerp Zoo Centre for Research and Conservation
CRIC	Centre for the Cement Industry
CRM	Centre de Recherches Métallurgiques
CSTP	Committee on Science and Technological Innovation Policy (from OECD)
DARIAH	Digital Research Infrastructures for the Arts and Humanities
DISSCO	Distributed System of Scientific Collections
EC	European Commission
ECT	European Centre for Theoretical Studies in nuclear Physics and Related Areas
ELAt	Eindhoven-Leuven-Aachen triangle
EEN	Enterprise Europe Network
ECOOM	Expertise Centre for Research & Development Monitoring
ECSEL	Electronic Components and Systems
EIS	European Innovation Scoreboard
EIT	European Institute for Technology
ELIXIR	Distributed Infrastructure for Life-science Information
EMB	European Marine Board
EMBRC	European Marine Biology Resource Centre

EMBO/L	European Molecular Biotechnology Organisation/Laboratory
EMODnet	European Marine Observation and Data Network
ESM	Efficient and Sustainable Manufacturing
EOS	Excellence of Science (co-operation between FWO and FNRS)
EPO	European Patent Office
ERA	European Research Area
ERAC	European Research Area and Innovation Committee (towards EC)
ERC	European Research Council
ERDF	European Regional Development Fund
ERRIN	European Regions Research and Innovation Network
ESA	European Space Agency
ESA BIC	European Space Agency Business and Innovation Centre
ESA 2010	European System of Accounts
ESF	European Science Foundation or European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
ESO	European Southern Observatory
ESRF	European Synchrotron Radiation Facility
ESS	European Social Survey
EU	European Union
EUA	European University Association
EUKA	Flemish Drone Federation
EWI	Economy, Science and Innovation
FACCE	Joint Programming Initiative on Agriculture, Food Security and Climate Change
FCH	Fuel Cells and Hydrogen
FFTF	Flanders Future Tech Fund

FIIVP	Flanders Inspires International Visitors Programme
FIT	Flanders Investment and Trade
FLAG	Flemish Aerospace Groep
FP	Framework Programme
FRIS	Flanders Research Information Space
FTE	Full-time equivalent
FOSB	Flemish Open Science Board
FUST	Flanders UNESCO Science Trust
FUSTIB	Flanders UNIDO Science Trust Fund for Industrial Biotechnology
FWO	Research Foundation Flanders
GBARD	Government Budget Appropriations for R&D
GBEV	Ghent Bio-Energy Valley
GDP	Gross Domestic Product
GDP(R)	Gross Domestic Product per Region
GERD	Gross Expenditure on Research and Development
GII	Global Innovation Index
GIMV	Flanders Investment Company
GOV	Government sector
GOVERD	Government Expenditure on R&D
HDHL	A Healthy Diet for a Healthy Life
HERD	Higher Education Research and Development Survey
HES	Higher education sector
HRRF	Human Resources in Research Flanders
HRST	Human Resources in Science and Technology
IBN	Innovative Business Networks
ICOS	Integrated Carbon Observation System

ICT	Information and Communication Technology
ILVO	Flanders Research Institute for Agriculture, Fisheries and Food
imec	Interuniversity Micro-Electronic Centre
IMI	Innovative Medicines Initiative
iMinds	Interdisciplinary Institute for Broadband Technology (as of end 2016. iMinds became a business unit of Imec)
INBO	Research Institute for Nature and Forest
INSTRUCT	Integrated Structural Biology Infrastructure
IOC	Inter-governmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange
IOF	Industrial Research Fund
IoT	Internet of Things
IPR	Intellectual property rights
IRE	Institute for Radioelements
IRI	Programme for International Research Infrastructure
IRMM	Institute for Reference Materials and Measurements
ISI	Fraunhofer Institute for Systems and Innovation Research
ITM	Institute for Tropical Medicine
IUS	Innovation Union Scoreboard
IV	International Flanders (policy area)
IWT	Agency for Innovation by Science and Technology
JPI	Joint Programming Initiative
JPND	Joint Programming on Neurodegenerative Diseases
JRC	Joint Research Centre
JTI	Joint Technology Initiative
KAGB	Royal Academy for Medicine of Belgium

KANTL	Royal Academy for Dutch Language and Literature
KBIN	Royal Belgian Institute of Natural Sciences
KBR	National Library of Belgium
KET	Key Enabling Technologies
KIC	Knowledge and Innovation Community
KIK	Royal Institute for Cultural Heritage
KMI	Royal Meteorological Institute of Belgium
KMKG	Royal Museums of Art and History
KMSK	Royal Museums of Fine Arts of Belgium
KMSKA	Royal Museum of Fine Arts Antwerp
KSB	Royal Observatory of Belgium
KU Leuven	Catholic University of Leuven
KVAB	Royal Flemish Academy of Belgium for Sciences and Arts
LERU	League of European Research Universities
LRM	Limburg Reconversion Company
METIS	Mid-Infrared ELT Imager and Spectrograph
MoU	Memorandum of Understanding
MYBL	More Years Better Lives
NACE	European Classification of Economic Activities
NCP	National Contact Point
NERF	Neuro-electronics Research Flanders
NESTI	National Experts on Science and Technology Indicators
NHP	National Reform Programme
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Cooperation and Development
OJO	Support of Young Researchers

OMC	Open Method of Coordination
QS	Quacquarelli Symonds (ranking)
PhD	Doctor of Philosophy
PCT	Patent Cooperation Treaty
PMV	Flanders Holding Company
PNP	Private non- Profit Sector
PPS	Purchasing Power Standard
PRACE	Partnership for Advanced Computing in Europe
PRO	Public Research Organisation
PWO	Practice-oriented scientific research (for universities of applied sciences and arts)
QS	Quacquarelli Symonds
R&D	Research and Development
R&I	Research and Innovation
R&D&I	Research, Development and Innovation
RIM	Regional Innovation Monitor
RIS	Regional Innovation Scoreboard
RTD	Research and Technological Development
RVO Society	Roger Van Overstraeten Society
RZSA	Royal Zoological Society of Antwerp
S&T	Science & Technology
S3	Smart Specialisation Strategy
SCC	Smart Cities and Communities
SCINNOPOLI	Scanning Innovation Policy Impact
SCK CEN	Belgian Nuclear Research Centre
SESAR	Single European Sky Air Traffic Management Research
SERV	Flanders Social and Economic Council

SFIC	Strategic Forum for International S&T Cooperation
SHARE	Survey of Health, Ageing and Retirement in Europe
SIRRIS	Collective Centre of the Belgian Technology Industry
SME	Small and Medium-sized Enterprises
SPIDER	Supporting Public Service Innovation using Design in European Regions
SPIRAL2	Système de Production d'Ion Radioactifs en Ligne de 2e génération
SRC	Strategic Research Centres
SSH	Socio-economic Sciences and Humanities
ST&M	Science, Technology and Mathematics
STEM	Science, Technology, Engineering, Mathematics
STI	Science, Technology and Innovation
STV	Foundation for Technology Assessment Flanders
SWOT	Strengths, Weaknesses, Opportunities and Threats (analysis)
TAFTIE	Association for Technology Implementation in Europe
TEKES	Finnish Funding Agency for Technology and Innovation
TETRA	TEchnology TRAnsfer by universities of applied sciences and arts
THE	Times Higher Education
TIP	Technology and Innovation Policy
TTO	Technology Transfer Office
UA	University of Antwerp
UE	Urban Europe
UGent	Ghent University
UHasselt	Hasselt University
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organization

UNU-CRIS	United Nations University – Centre for Regional Integration Studies
USPTO	United States Patent and Trademark Office
VABB	Flemish Academic Bibliografic Database
VARIO	Flemish Advisory Council for Innovation and Entrepreneurship
VHP	Flemish Reform Programme
VIB	Flanders Institute for Biotechnology
VIL	Flanders Institute for Logistics
VITO	Flemish Institute for Technological Research
VKI	Von Karman Institute
VLAIO	Flanders Innovation and Entrepreneurship Agency
VLAST	Flemish Academic Centre for Science and the Arts
VLEVA	Liaison Agency Flanders-Europe
VLHORA	Council of Flemish Universities of Applied Sciences and Arts
VLIR	Flemish Inter-Univerisity Council
VLIZ	Flanders Marine Institute
VRT	Flemish Radio and Television Broadcasting
VRWB	Flemish Science Policy Council
VRWI	Flemish Council for Science and Innovation
VUB	Vrije Universiteit Brussel
WIPO	World Intellectual Property Organisation
WP	Scientific Staff
WTOCD	Scientific and Technological Research Centre for Diamond
ZAP	Senior Academic Staff

LIST OF FIGURES

LIST OF TABLES

DEPARTMENT OF
ECONOMY
SCIENCE &
INNOVATION

info.ewi@vlaanderen.be
ewi-vlaanderen.be